Understanding the structure and role of academics' ego-networks on social networking sites

Thesis

Understanding the structure and role of academics' ego-networks on social networking sites

Katy Jordan

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Abstract

Academic social networking sites (SNS) seek to bring the benefits of online networking to an academic audience. Currently, the two largest sites are Academia.edu and ResearchGate. The ability to make connections to others is a defining affordance of SNS, but what are the characteristics of the network structures being facilitated by academic SNS, and how does this relate to their professional use by academics?

This study addressed this question through mixed methods social network analysis. First, an online survey was conducted to gain contextual data and recruit participants (n = 528). Second, ego-networks were drawn up for a sub-sample of 55 academics (reflecting a range of job positions and disciplines). Ego-networks were sampled from an academic SNS and Twitter for each participant. Third, co-interpretive interviews were held with 18 participants, to understand the significance of the structures and how the networks were constructed.

Academic SNS networks were smaller and more highly clustered; Twitter networks were larger and more diffuse. Communities within networks are more frequently defined by institutions and research interests on academic SNS, compared to research topics and personal interests on Twitter. Emerging themes link network structure to differences in how academics conceptualise and use the sites. Academic SNS are regarded as a more formal academic identity, akin to a business card, or used as a personal repository. Twitter is viewed as a space where personal and professional are mixed, similar to a conference coffee break. Academic SNS replicate existing professional connections, Twitter reinforces existing professional relationships and fosters novel connections. Several

strategies underpinning academics' use of the sites were identified, including: circumventing institutional constraints; extending academic space; finding a niche; promotion and impact; and academic freedom. These themes also provide a bridge between academic identity development online and formal academic identity and institutional roles.

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Abbreviations used

AIF	Acceptable identity fragments
AERA	American Educational Research Association
API	Application programming interface
BERA	British Educational Research Association
CSV	Comma separated values
CV	Curriculum vitae
ECR	Early career researcher
ESRC	Economic and Social Research Council
HEI	Higher Education institution
HESA	Higher Education Statistics Authority
HREC	Human Research Ethics Committee
ID	Identifier
MOOC	Massive open online course
NPG	Nature Publishing Group
OER	Open educational resources
PDF	Portable document format
RCUK	Research Councils UK
REF	Research Excellence Framework
RG score	ResearchGate score
RQ	Research question
SNA	Social network analysis
SNS	Social networking sites
STS	Science and technology studies
ToS	Terms of service

1. Introduction

The development of the internet and world wide web have had a profound effect upon society, revolutionising how we communicate, interact and access information, ushering in a new age of a ‘network society’ (Castells, 2009). Virtually all aspects of society have been affected as we move towards a more connected, open and information rich society (Rainie & Wellman, 2012).

This study is set within a broader research context concerned with understanding the effects of the internet and web-based technologies within the context of academia. Digital scholarship focuses upon how such technologies are transforming scholarly practice (Weller, 2011), encompassing a range of social and technological factors. Alternative epithets include ‘Cyberscience 2.0’ (Nentwich & König, 2012), ‘Science 2.0’ (Codina, 2009; European Commission, 2015), ‘Social scholarship’ (Greenhow, 2009) and related terms.

Digital scholarship represents a complex and challenging research area. The potentially transformative effects of such technologies may be enacted through a range of scholarly practices (Pearce, Weller, Scanlon & Kinsley, 2010) and permeate a range of levels of actors comprising the Higher Education context (Fransman, Coughlan, Farrow & Weller, 2012). The complexity is compounded by the fact that the technologies are numerous, constantly developing and subject to differing scholarly traditions and practices in different academic disciplines (Borgman, 2007; Harley, Acord, Earl-Novell, Lawrence & King, 2010). While there is great potential for online and digital tools to revolutionise academic work, how this is being realised in practice, in different settings, is an open question and active research area at present.

Social networking sites (SNS) are the technologies in focus in this study. SNS are defined as online tools which allow users to create a profile and make connections with others (boyd & Ellison, 2007; Hogan & Wellman, 2014). While SNS represent only one of a range of social media tools available to academics, they are of interest due to the development of a number of services aimed specifically at academics (Nentwich & König, 2012), following the surge in popularity of generic tools over the past decade (boyd & Ellison, 2007; Rainie & Wellman, 2012). This study is underpinned by a question of whether academics' use of such tools is creating new patterns of academic networking or working more generally. This focus aligns the study with a stance derived from digital scholarship more generally, that is, of networked participatory scholarship (Veletsianos, 2016; Veletsianos & Kimmons, 2012).

Networked participatory scholarship is particularly focused upon the relationship between social, networked tools and academic practice, through examining the ways that "scholars' participation in online social networks to share, reflect upon, critique, improve, validate, and otherwise develop their scholarship" (Veletsianos & Kimmons, 2012, p.766). In her recent work focusing on academics' use of Twitter, Stewart (2015a) makes the link between networked participatory scholarship and Boyer's model of scholarship (Boyer, 1990). Through their use of the platform, the academics interviewed were found to enact Boyer's dimensions of scholarship, but that this model was insufficient as their practices go further, "fostering extensive cross-disciplinary, public ties and rewarding connection, collaboration, and curation between individuals rather than roles or institutions" (Stewart, 2015a, p.318). This reframing of benefits to individuals harks back to Rainie and Wellman's (2012) broader social notion of networked individualism. This study

therefore locates itself in this conceptual space, between digital scholarship, networked participatory scholarship, and traditional scholarship, the relationships between these concepts are summarised in Figure 1.1.

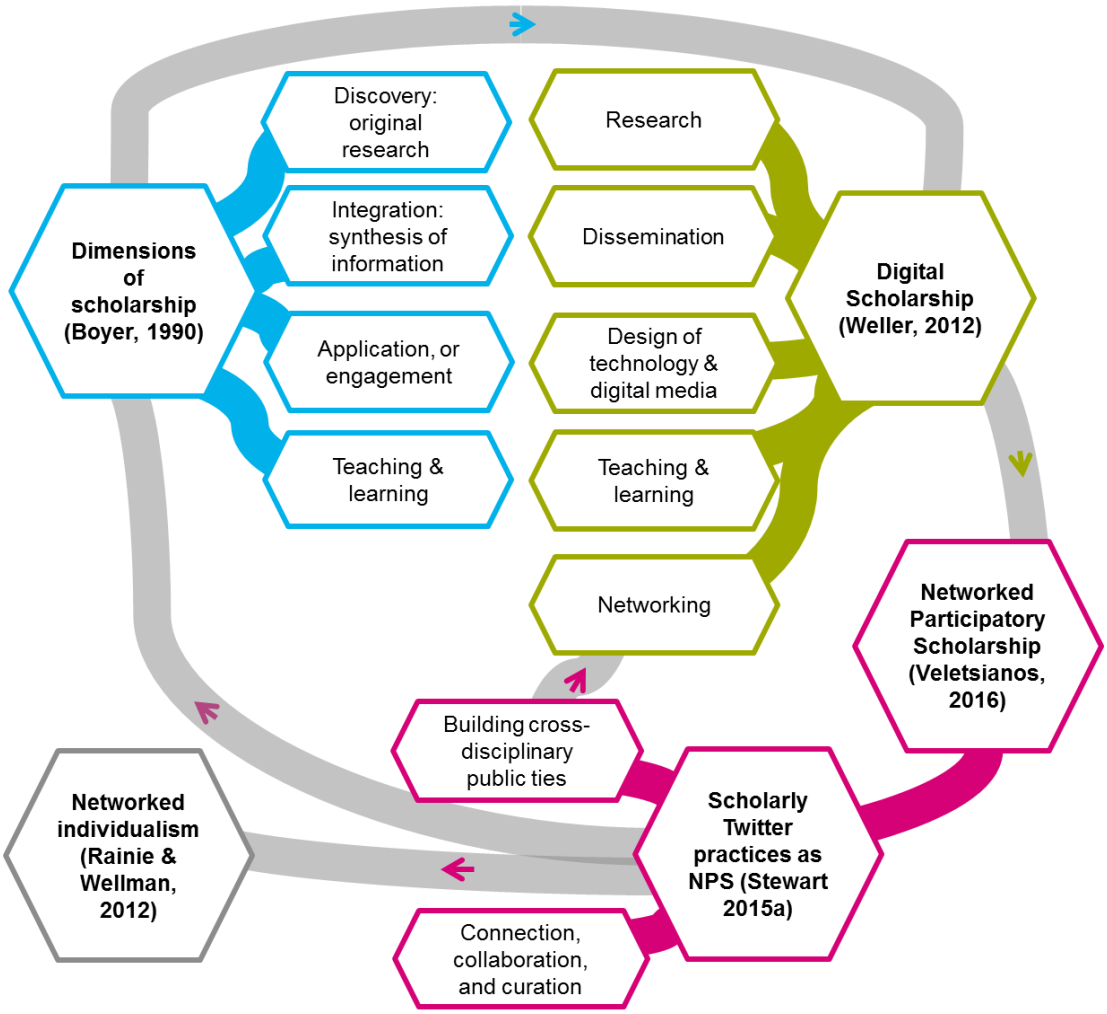


Figure 1.1: Links between traditional scholarship, digital scholarship and networked participatory scholarship which frame this study.

In this introductory chapter, the potential benefits of social media and so-called 'web 2.0' tools for academia will be discussed. The extent of uptake and barriers to engagement will be reviewed. The role of SNS within academia will be made explicit, before the current empirical work relating to academics' use of SNS is introduced in Chapter 2. The focus of the study and research questions (RQs),

which foreground the networked character of such sites, will be addressed in Chapter 3.

1.1 Social media and the promise of web 2.0 for academia

'Science 2.0' and related terms draw inspiration from the phenomenon known as 'web 2.0' (O'Reilly, 2005). Web 2.0 refers to the progression of web technologies from static, read-only type webpages, to user-generated content. Social media has enabled the web 2.0 vision to be realised, referring to a broad spectrum of web-based applications which enable users to host and share a variety of types of digital content (Kaplan & Haenlein, 2010). A wide variety of applications can be regarded as social media (Cann, Dimitriou & Hooley, 2011); an overview is shown in Figure 1.1.1.

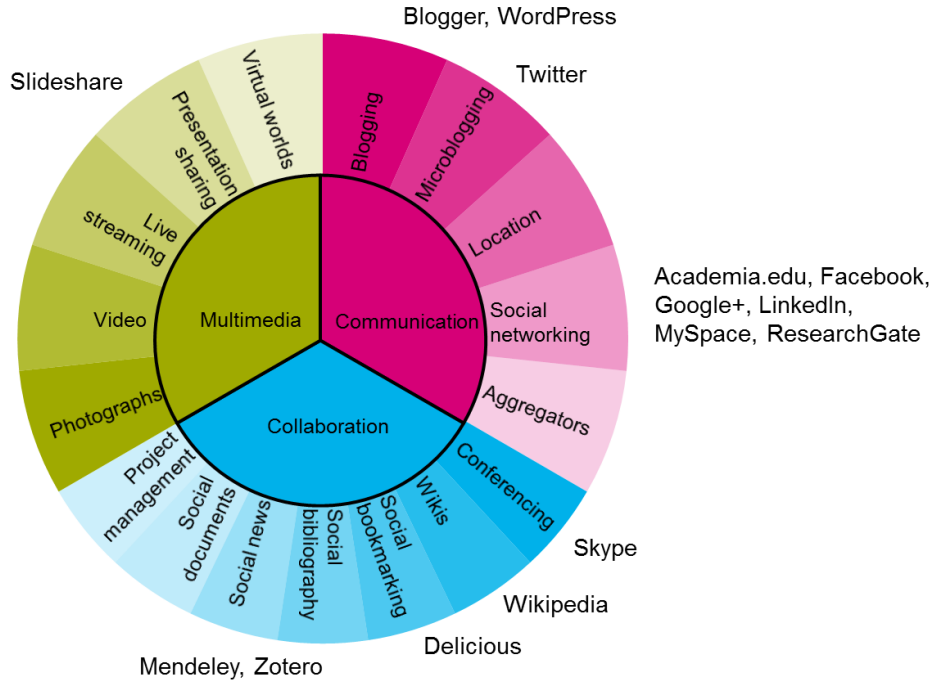


Figure 1.1.1: Overview of the main types of social media tools, with examples. Typology adapted from table on page 7 of Cann, Dimitriou and Hooley (2011); examples drawn from main studies of academics' use of social media (see Section 1.2).

The typology shown in Figure 1.1.1 is illustrated with examples of the most popular tools with academics, according to studies which will be reviewed in Section 1.2. Note that tools to gauge the impact of research outputs (such as Google Scholar) are absent from the general typology. A corollary of social media has been the importance of going beyond sharing content to making social connections and interactions between users (Anderson, 2007), which is foregrounded particularly in SNS. This is reflected in the trend for platforms which began as content-sharing websites to then add social networking capabilities (boyd & Ellison, 2007).

A range of potential benefits offered by social media to academia have been identified. Using the example of social bookmarking tools, Greenhow (2009) illustrates the power of combining social connection with resource management. She highlights how access to academics' libraries may be particularly beneficial to students, assisting with discovery of resources, peers, and developing critical assessment skills (Greenhow, 2009). In addition to social bookmarking tools, Nentwich (2010) assessed the potential academic roles for academic SNS, wikis, blogs and microblogging tools (Twitter). Drawing upon the nascent academic literature on the topic, this identified a wide range of different ways that social media can enhance scholarly activities, with consideration of the particular strengths of different tools. These include:

- Social aspects (such as finding new collaborators) were highlighted in relation to academic SNS.
- Wikis were identified as supporting active collaborative working.

- A variety of affordances were described in relation to blogging, including: communicating research to a variety of audiences, supporting discussions (including new forms of open peer review), resource aggregation, identity development and as reflective journals.
- In addition to new forms of scientific communication, advantages identified in relation to microblogging included supporting collaboration, informal or social communication, supporting teaching and adding an extra layer of discourse to conferences (Nentwich, 2010).

A proliferation of academic SNS occurred in 2008 (see Figure 2.1.1); since 2011, several platforms have ceased to exist. While the number of academic SNS has decreased, their use had polarized around a smaller number of more popular services (principally, Academia.edu and ResearchGate, which boast membership figures in millions). This has been accompanied by a sharper focus upon the affordances of such tools for academics. Jahnke and Koch (2009) discuss the benefits of web 2.0 for academia in terms of three themes: Information, collaboration and cooperation; communication; and networking. Focusing particularly on academic SNS and social bookmarking tools, Bullinger, Hallerstede, Renken, Soeldner and Moeslein (2010) analysed site functionalities to develop a typology of affordances of academic online networks, which comprised: identity and network management, communication, information management, and collaboration. Considering two academic SNS (Academia.edu and ResearchGate) and one social bookmarking tool (with built in social networking; Mendeley), Giglia (2011) emphasises the importance of finding publications, collaboration via group formation, and receiving news such as updates from peers and job opportunities.

The relative importance of different types of support via social media may exhibit a disciplinary character (Borgman, 2007). For example, in the context of biocomputing, Neylon and Wu (2009) primarily emphasise the role of data-sharing platforms, while blogging is the principal social media tool identified as beneficial. In reviewing social media 'for Scientists', Bik and Goldstein (2013) also foreground blogging, emphasising the power of social media in terms of communication and impact tracking. There is a question of the extent to which social media use by academics inherits disciplinary attitudes to open practices (Costa, 2013) or transcends disciplinary boundaries (Weller, 2014). Drawing upon interviews with academics focusing upon their use of Twitter, Stewart (2015a) argues that networked scholarship through this lens emphasises cross-disciplinary ties, public connections, collaboration, and refocuses upon individuals as opposed to institutions or formal academic positions.

Increasingly, the benefits of social media for academics have coalesced in terms of:

(i) sharing and discovering resources

(ii) supporting collaboration

(iii) identity development (including reputation and impact tracking), and

(iv) communication.

Despite the potential for social media to support a wide range of scholarly activities, their uptake has been restricted to an extent, and several barriers to engagement have been identified. As Veletsianos (2016) argues, refocusing upon how the tools are used in practice, rather than upon their potential, is under-studied at present.

1.2 Extent of uptake

Assessing the extent of uptake of social media tools by academics has been the focus of a number of studies. The scope and approaches of the studies are summarised in Table 1.2.1.

Table 1.2.1: Summary of studies which address the extent of social media uptake by academics.

Study	N	Sample	Method
Carpenter, Wetheridge & Smith (2010)	13,593	UK based. Circulated via UK HEIs.	Online survey plus smaller longitudinal cohort study
Procter, Williams, Stewart, Poschen, Snee, Voss & Asgari-Targhi (2010)	1,477	UK based. Circulated via ac.uk email addresses.	Online survey plus semi-structured interviews
Nicholas & Rowlands (2011)	2,414	International. Circulated via publisher's network.	Online survey
Madhusudhan (2012)	160	Postgraduate research students at the University of Delhi.	Questionnaire
Ruleman (2012)	123 (faculty; also surveyed 699 students)	University students and faculty at the University of Central Missouri.	Online survey
Cruz & Jamias (2013)	86	Researchers at the University of the Philippines Los Baños.	Online survey
Al-Aufi & Fulton (2014)	78	Academics in Humanities and Social Sciences at Sultan Qaboos University, Oman (SQU).	Online survey
Lupton (2014)	711	International. Circulated via social media and email lists.	Online survey
Nature Publishing Group (2014) / Van Noorden (2014)	3,509	International. Circulated via publisher's network.	Online survey
Al-Aufi & Fulton (2015)	382	Academics in Humanities and Social Sciences at SQU and University College Dublin.	Online survey

Studies typically employ survey-based research methods, and can be divided into two categories; larger-scale international studies (Lupton, 2014; Nicholas & Rowlands, 2011; Van Noorden, 2014), and those which focus upon individual

institutions (Al-Aufi & Fulton, 2014; Al-Aufi & Fulton, 2015; Cruz & Jamias, 2013; Madhusudhan, 2012; Ruleman, 2012; Singh & Singh Gill, 2015). Online surveys are the most frequently used research method. As a result, it is possible that less frequent or non-users may be less well represented. Note that the studies included in Table 1.2.1 have been selected for specifically addressing use of social media by academics, not students (with the exception of Carpenter, Wetheridge and Smith (2010), who cast doctoral students as 'Researchers of tomorrow'). The studies address the extent of uptake in terms of both the purposes for which academics use social media, and the specific platforms they use.

While all of the studies in Table 1.2.1 address academics' use of social media in terms of types of functions that tools play, the use of a variety of different typologies prevents direct comparability between studies. This is also reflected in the diversity of results reported, even when focusing only on the most frequently reported aspects. For example, Nicholas and Rowlands (2011) report the three most popular types of social media used by researchers as 'Collaborative authoring' (62.7%), 'Conferencing' (48.3%), and 'Scheduling and meeting tools' (41.0%). 'Social networking' was identified by 27.0% of the sample (Nicholas & Rowlands, 2011). In contrast, 'Collaborative authoring' was only raised by 21% of the Delhi sample, and 'social networking' the second most prevalent use (69%) after 'Communication tools' (80%) (Madhusudhan, 2012). 'Social connections' were identified as the most important use by academics at Sultan Qaboos University and University College Dublin (Al-Aufi & Fulton, 2014; Al-Aufi & Fulton, 2015). Collaborative authoring and social networking-related uses do not rank as highly as uses relating to receiving and managing information (Carpenter, Wetheridge & Smith, 2010, p.37).

A subset of the studies outlined in Table 1.2.1 asked academics about their use of specific tools (Lupton, 2014; Madhusudhan, 2012; Nature Publishing Group, 2014; Ruleman, 2012). The exact phrasing of questions, tools surveyed and percentage of respondents who used each tool in the four studies is shown in full in Appendix A. Level of use of platforms which were included in at least two studies are shown in Table 1.2.2.

Table 1.2.2: Percentage of academics who reported using different social media platforms.

Typology	Platform	Madhusudhan (2012)	Ruleman (2012)	Nature Publishing Group (2014)	Lupton (2014)
Blogging	A blog	57.5			32.0
Microblogging	Twitter	17.5	5.0	14.4	90.0
Social networking	Academia.edu			8.1	49.0
	Facebook	77.5	49.6	40.5	42.0
	Google+			21.7	21.0
	LinkedIn	10.6	15.5	40.8	60.0
	MySpace	23.8	1.6		
	ResearchGate			46.2	33.0
Social bookmarking	Delicious	11.3	4.9		
Photographs	Flickr	40.0	5.9		5.0
Video	YouTube	60.0			25.0
Presentation sharing	Slideshare	20.0			13.0
Impact	Google Scholar			62.6	1.0

Note that there were an additional two groups of tools which were included in at least two studies but with different terminology: wikis and social bibliographic tools. 85% of respondents surveyed by Madhusudhan (2012) reported using wikis, in contrast to over 70% of doctoral students surveyed had never “maintained or collaborated online” using wikis (Carpenter, Wetheridge & Smith, 2010, p.36).

While Lupton (2014) asked respondents about social bibliographies as a whole ("Online referencing e.g. Mendeley, Zotero"; used by 20% of respondents), 2.5% of respondents in Ruleman (2012) use Zotero, and 7.7% of the academics surveyed by Nature use Mendeley (NPG, 2014).

Table 1.2.2 illustrates a number of notable characteristics. First, there is a good deal of variation between different studies. Second, social networking tools are those most consistently included in surveys. Third, generic tools (in comparison to those aimed specifically at academics) enjoy the highest levels of use (also noted by Nicholas & Rowlands, 2011). A temporal factor may also be present, although the studies represent only a two-year period which makes it difficult to assess. Peer pressure has been identified as a factor experienced by academics when adopting social media for their professional practice (Kieslinger, 2015), which is likely to be exacerbated over time.

The Nature survey data is notable in that a section of the survey asked participants about the ways in which they use specific sites (NPG, 2014). Twitter was strongly used for a range of active professional practices, while academic SNS showed a similar use profile to LinkedIn (Van Noorden, 2014). Despite the finding that Twitter is used by academics for a range of active practices, research upon academic use of Twitter is dominated by a focus upon its use or potential to support teaching (Ahmad Kharman Shah, Latif Shabgahi & Cox, 2015). The data were originally presented in Nature as radar charts, although the sub-samples per site also included responses from academics who had never used the site. The radar charts are shown, redrawn from the original data (NPG, 2014) and excluding non-users, in Figure 1.2.1.

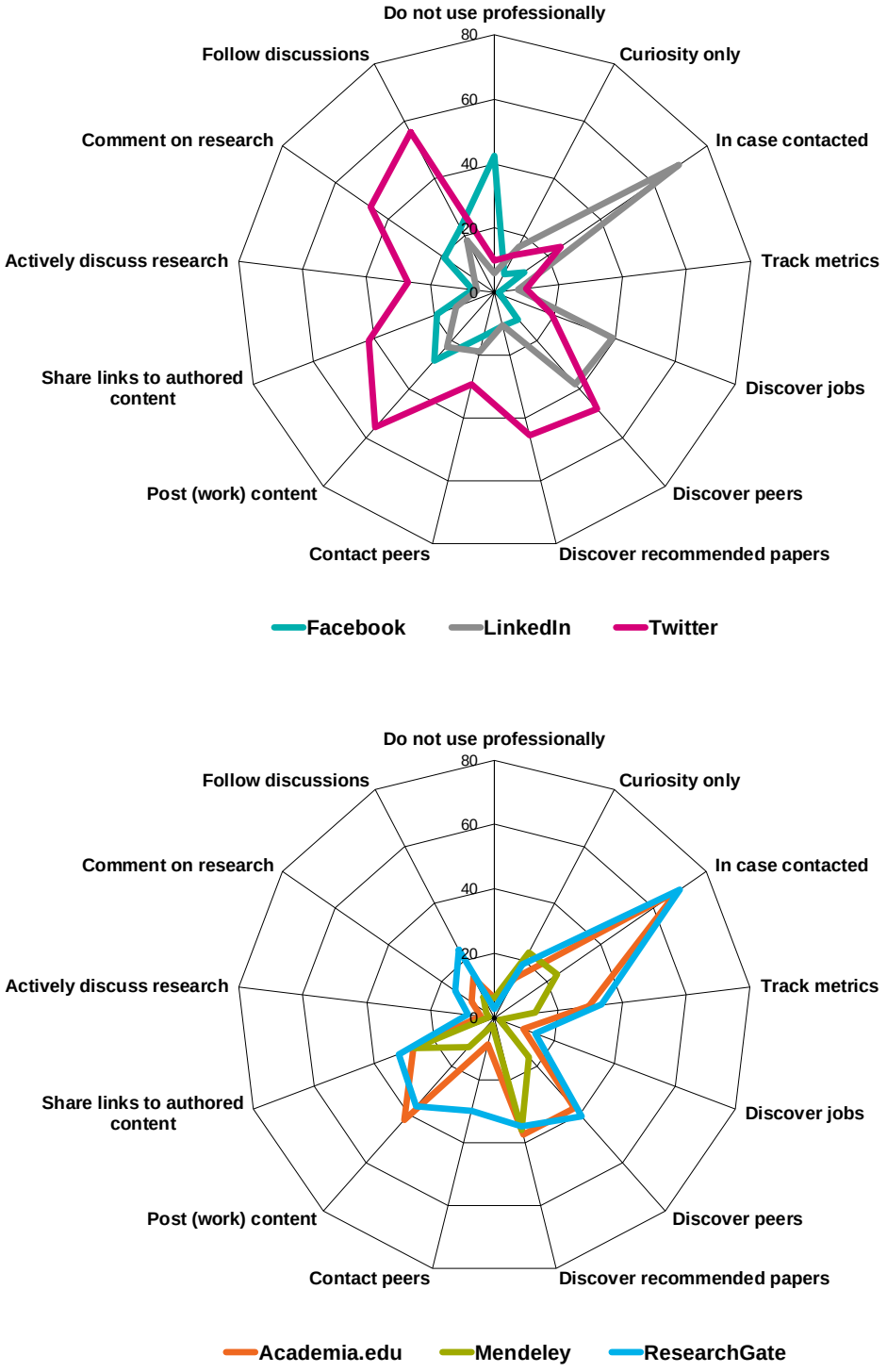


Figure 1.2.1: Percentage of respondents (from a sub-sample of the Nature survey) who use different SNS for particular purposes.
Redrawn from raw data (NPG, 2014).

Two smaller-scale studies have examined demographic characteristics of academic SNS profiles from a particular geographic location, combined with survey methods to address academics' reasons for using the sites. Nández and Borrego (2013) included analysis of 1,263 profiles of Catalan academics, and 293 survey responses. Based on the profile analyses, faculty members (43.2%), graduate students (31.6%) and department members (12.0%) made up the majority of profiles. The majority of survey respondents identified their discipline as Social Sciences (47%) or Arts and Humanities (22%). The main reasons for using Academia.edu were to get in touch with other researchers (67.2%), disseminate research output (61.4%), follow other researchers' activities (58.7%) and to disseminate curriculum vitae (39.6%) (Nández & Borrego, 2013).

Elsayed (2016) conducted an online survey of Arab researchers, which garnered 315 responses. Focusing upon users of ResearchGate, the disciplinary differences are corroborated, with few respondents from Arts, Humanities (1.6%) and Social Sciences (0.3%). 82.5% of respondents were faculty members; in contrast with Nández and Borrego (2013), relatively few (4.5%) were graduate students. The most frequently reported activities undertaken via ResearchGate were uploading publications (75.6%), editing their profile (51.4%), use as a search engine (43.4%), following researchers (41.2%) and the ResearchGate score (38.7%), although 81% belonged to other academic SNS in addition to ResearchGate and their activities there were not explored (Elsayed, 2016).

When considering social media use by academics in terms of different uses or specific tools, there is a lack of consensus and wide variation in the reported extent of uptake. Differences in terminology, sampling strategies and the flux of

new social media tools may contribute to the challenge of accurately gauging uptake. This variation and combination of potential factors underscores the value of moving away from large-scale surveys and focusing upon the relationship between individual academics and their personal use of social media tools in relation to their academic practice.

1.3 Barriers

Technical and social tensions exist between social media tools and formal Higher Education structures. In technical terms, the development of open access repositories (such as DSpace and ePrints; Borgman, 2007) raises a question of the relationship between institutional tools and social media. Kelly and Delasalle (2012) argue that online profiles in academic social media (particularly SNS, and publication records such as Google Scholar and Microsoft Academic) can usefully co-exist with institutional repositories; the social media tools having greater web visibility, making them a valuable way of directing users to items hosted in repositories. While the use of Open Social web standards has been advocated for portability of profiles across institutional and third-party academic networking tools (Boston, 2009), integration is yet to be realised. Bittner and Muller (2011) identify quality and standardisation of data, and the requirement for complex access and management rights, as barriers to this. However, Procter et al. (2010) caution against standardisation and imposition of web 2.0 tools, arguing that the best institutional support would come from allowing academics the flexibility and support to experiment with the technology in relation to their own practices. Reflecting the impact of the internet and social media in reshaping academic roles,

Ward, Bejarano and Dudás (2015) highlight the potential role for academic librarians in assisting academics in online identity management via SNS.

In social terms, tensions arise from the fact that social media is not viewed exclusively in positive terms by institutions (Costa, 2013; Costa, 2014a). Although social media offers new opportunities for communicating research and tracking impact, these channels are often not recognised in relation to promotion and career progression (Gruzd, Staves & Wilk, 2011). An uneasy relationship between the values of traditional Higher Education and the 'open scholarship' practised through online tools and social media can create a fragmented sense of academic identity (Costa, 2014b; Kimmons & Veletsianos, 2014). The perceived muddying of professional and private identities online is also a source of tension (Veletsianos & Kimmons, 2013). The merging of identities and content can also leave academics vulnerable to abuse and trolling (Veletsianos, 2016; Singh, 2016; Stewart, 2015c).

In the climate of ever increasing pressure upon the Higher Education sector to increase productivity and efficiency, online social networking may be seen to appeal to institutions keen to increase and quantify engagement and impact of their research. In this sense, encouraging use of academic SNS may become part of an institutionalised, lip service approach to open and digital scholarship, curtailing the benefits to academics (Carrigan, 2015). A corollary of the potential use for SNS to enhance impact and provide metrics is a caution that the networks and altmetrics could be abused, to provide an impoverished assessment of scholars' worth or facilitate surveillance.

At the heart of the uneasy relationship between the institution and social media is an issue of the legitimacy of its use in academic practice (Jahnke & Koch, 2009;

Veletsianos & Kimmons, 2012). Carmichael and Burchmore (2010) highlight the need for online tools to be adaptable in order to support variety in academic practices. Perceptions that social media tools and open practices waste time and do not yield benefits to researchers present a barrier to uptake, which may differ according to disciplines (Armstrong & Franklin, 2008; Donelan, 2016; Esposito, 2013). This may reflect issues relating to the need to develop digital literacies and skills as part of researcher training and identity development (Cardoso & Oliveira, 2015; Kimmons, 2014; Zhu & Procter, 2015). Given that the range and extent of perceived benefits has been shown to be greater with increased levels of use (Donelan, 2016), overcoming the initial barriers to experiment with tools is a critical issue. Increasing awareness of the benefits and practical experiences of academics may help to overcome the initial barriers to adoption.

1.4 Research context and contribution

Web-based technologies, particularly social media, offer many potential benefits to those working in Higher Education, in relation to communication, collaboration, sharing resources, and developing an online identity. As such, use of social media could radically change how a number of aspects of academic work are conducted. However, uptake of tools is uneven so far, and their use is yet to become fully integrated into academic practice. Barriers to widespread adoption include issues related to interoperability, digital literacy, concerns about online identities, time and workload, the legitimacy of their use in scholarly work and the relationship with traditional Higher Education.

An enhanced understanding of the role which social media is playing in practice within academia is therefore valuable in order to help overcome these barriers and

assist in realising the potential of such tools. While social media comprises a wide variety of tools, considering the context discussed here, this study is focused upon academic SNS. Academic SNS are an interesting focus for research as they have been developed specifically with the affordances of social media to academia in mind. Inspired by the popularity and profitability of generic SNS, academic SNS represent a way of lowering the technical bar to participation, while occupying a space independent of traditional institutions. An empirical contribution to the field is timely as academic SNS are under-studied from a networked participatory scholarship perspective (as we shall discuss in the next chapter), and have received renewed interest through the recent #DeleteAcademiaEdu hashtag campaign. The hashtag emerged from Academia.edu's initiative to allow members to have their publications highlighted on the website in exchange for a monetary fee, and highlights that while academic SNS are relied upon by an increasing number of academics as a host to their academic identity and publications, the platforms are commercial enterprises and their goals will not always align with academia and the community they support (Matthews, 2016).

Set against this context, the study will address an over-arching RQ of 'how are social networking sites (re)shaping academic roles and relationships?'. This is underpinned by the following questions:

- RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?
- RQ2: How do academics construct and understand their ego-networks?
- RQ3: Does the structure and/or role of the network differ in nature according to academic career trajectories?

The following peer-reviewed papers have been published (or successfully reviewed and accepted for publication) on the basis of this thesis and related work:

- Jordan, K. (2014) Academics and their online networks: Exploring the role of academic social networking sites. First Monday, November 2014. This paper reported the results of the pilot study (Chapter 3).
- Jordan, K. (2016) Academics' online connections: Characterising the structure of personal networks on academic social networking sites and Twitter. Proceedings of the Networked Learning Conference, Lancaster, UK, 9th-11th May 2016. In this paper, the results of the network analysis (Chapter 6) were presented.
- Jordan, K. (2016, forthcoming) Digital scholarship and the social network site: How academics conceptualise their networks on academic social network sites and Twitter. Paper to be presented at the annual Association of Internet Researchers conference, Berlin, Germany, 6th-8th October 2016, and included in Selected Papers in Internet Research (SPIR). In this paper, the results of the co-interpretive interviews will be presented (Chapter 7).

1.5 Structure of the thesis

In this introductory chapter, the context for the study has been set. SNS are one type of a range of tools through which digital scholarship or networked participatory scholarship is enacted. Academic SNS have been designed to bring the potential benefits of online networking to an explicitly academic audience, but there are differing reports about the extent of uptake and their role in relation to academic practice and other digital tools.

The following overview introduces and summarises the structure of the thesis:

- In Chapter 2, the current body of empirical research relating to academic SNS will be critically reviewed.
- Chapter 3 will describe the rationale for taking a network analysis-focused approach to understanding the phenomenon of academic SNS, including how this was shaped by the findings of the pilot study.
- Chapter 4 will focus upon the methodology of the study. Informed by the philosophical underpinnings of the RQs, the choice of mixed-method social network analysis as a methodology is discussed. Specific research methods and details of their practical execution are also outlined.
- Chapters 5, 6 and 7 will present results of the study.

  Chapter 5 will report on findings from the survey; Chapter 6, the network analysis; and Chapter 7 will present detailed case studies from the interview participants.
- In Chapter 8, an analysis of data from all phases of the project will be presented, in explicit relation to the RQs.
- Chapter 9 will summarise the conclusions and contribution of the study, acknowledging its limitations and avenues for future work.

2. Research themes in academic social networking online

Chapter 1 introduced the digital scholarly landscape, and the wide range of social media tools which may play roles within this. It was argued that academic SNS are of particular interest as an object for research as they are tools which aim to exploit the benefits of social networking online - which is at the heart of all social media - but to a mass, specifically academic, audience. Academia has been identified as an area where the affordances of online connection may be particularly beneficial, yet social and technical barriers exist in relation to uptake. Academic SNS potentially lower the technical bar to engagement, but what role do the platforms play in mediating and reshaping scholarly practices and relationships?

This chapter will focus upon the existing research literature related to academic SNS, discussed in relation to prominent themes. First, the bounds of the literature review will be set out. For the purposes of reviewing the field, what is the definition of an academic SNS?

2.1 Defining academic SNS

The definition of an academic SNS used here builds upon the seminal definition of a SNS (boyd & Ellison, 2008, p.211):

> We define social network sites as web-based services that allow individuals to:
>
> (1) construct a public or semi-public profile within a bounded system,
>
> (2) articulate a list of other users with whom they share a connection, and

(3) view and traverse their list of connections and those made by others within the system.

While the main purpose of the site may vary, the key distinction is being able to create a profile, make links to others, and be able to navigate through lists of connections. For the purposes of this study, academic SNS are defined as any sites which fulfil the boyd and Ellison definition, with the added criterion that the service they are providing has been explicitly aimed at the academic community. Academic SNS which fit this definition may be divided into two categories: those which have been developed primarily to facilitate profile creation and connection (analogous to Facebook; examples include Academia.edu and ResearchGate), and those with a primary focus on posting and sharing academic-related content and have subsequently added social networking capabilities (such as Mendeley or Slideshare). Note that a number of the former platforms have been discontinued in recent years. Academic SNS are typically free to use although this is not a defining characteristic. The timeline shown in Figure 2.1.1 charts the launch (and demise) of different platforms which can be considered academic SNS, and launch dates of major generic SNS for comparison.

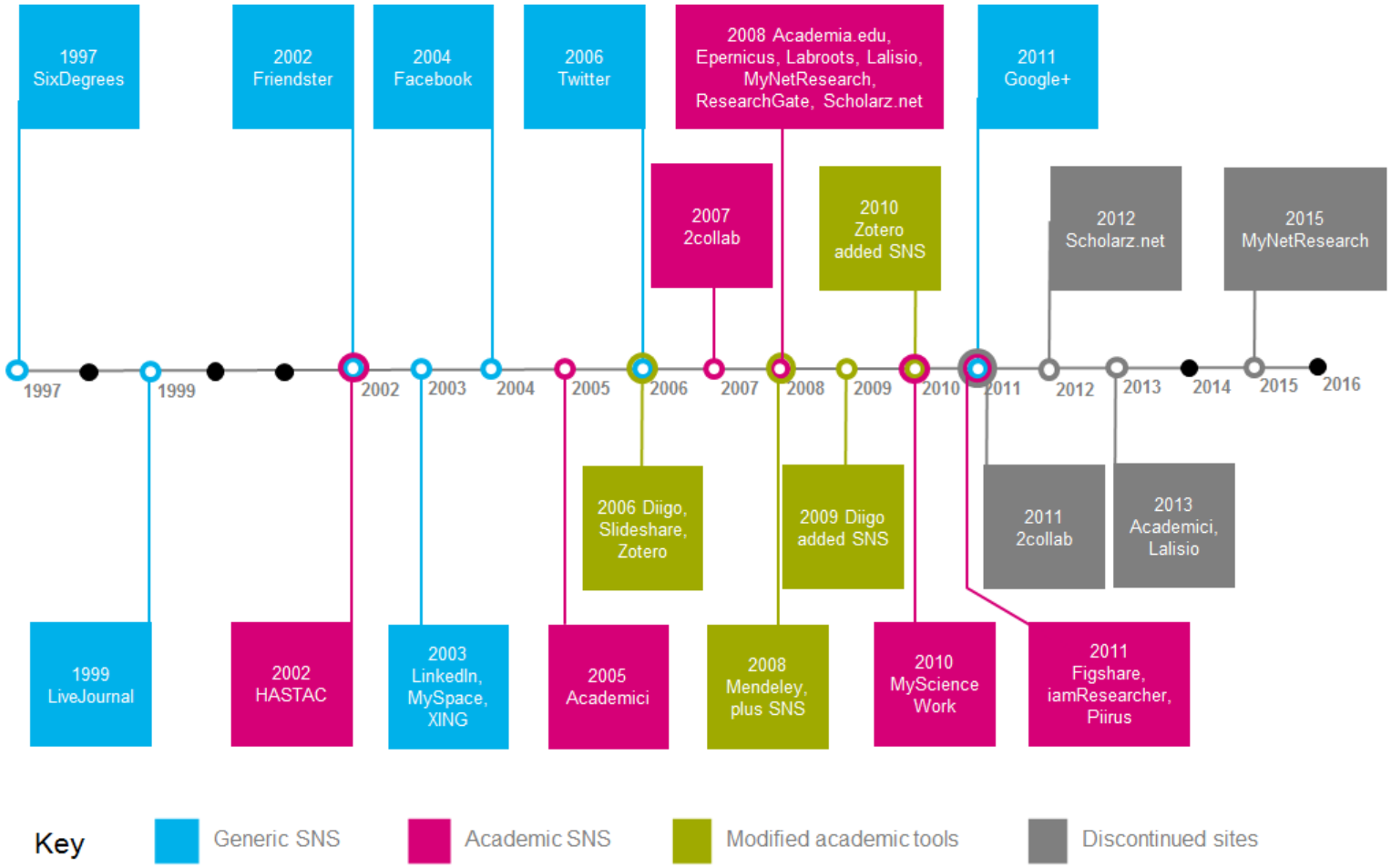


Figure 2.1.1: Timeline of launch dates of academic SNS (pink) and academic tools which have subsequently added social networking functionality (green). Major generic sites are shown in blue for comparison. Where known, dates when now defunct academic SNS closed are shown in grey.

Two main studies have sought to further characterise academic SNS by mapping services to typologies of functions. Bullinger et al. (2010) consider the functions of ten academic SNS and propose four dimensions to a typology of academic SNS: information management; collaboration; identity and network management; and communication. However, since this analysis was undertaken, several of the sites included in the analysis have ceased and others have changed their model. Academia.edu and ResearchGate have expanded to a much greater extent and secured their positions as the principal academic SNS (Duke & Jordan, 2011; Van Noorden, 2014). Espinoza Vasquez and Bastidas (2015) recently built upon this work with analysis of a small sample of the largest academic SNS (Academia.edu, ImpactStory, LinkedIn, Mendeley, ResearchGate).

While there is variation in the specific tools present on different sites, the following five themes were identified (Espinoza Vasquez & Bastidas, 2015):

(1) collaboration,

(2) online persona management,

(3) research dissemination,

(4) documents management, and

(5) impact measurement.

This broadly reflects the Bullinger et al. (2010) typology, with the addition of impact measurement, which may highlight a move towards interest in altmetrics. It should be noted however that there is evidence that the typologies of functions may also be applicable to how academic use generic SNS (Van Noorden, 2014).

This literature review chapter draws upon empirically-based research publications which focus upon academic SNS or academics' use of generic SNS for

professional purposes. Note that the term ‘academics’ here is used to denote those with jobs in Higher Education, and PhD students (as the doctorate is arguably an apprenticeship into academia). Research and teaching roles are considered. Studies focused upon undergraduate students are not included as their use of social media has received greater focus already in discourses related to ‘digital natives’ (Jones, 2011), and a high proportion will not continue into academic careers. The discussion will be organised according to themes which emerged from the body of literature, and exhibits some similarity with the typologies of sites (Bullinger et al., 2010; Espinosa Vasquez & Bastidas, 2015), although there is degree of overlap between different themes. Based on the literature included in the review here, the distinction is made between informal communication and formal communication (the latter combining new publishing routes and measurement of scholarly impact). The themes will therefore be discussed as follows:

- Informal communication
- Publishing and impact
- Collaboration
- Demographics and identity

While the themes have been derived primarily based on the academic SNS literature, the themes show similarity with other social media (particularly Twitter; Lemon, McPherson & Budge, 2015). Findings from other platforms will be drawn upon in instances where empirical work from academic SNS is entirely lacking or contradictory.

2.2 Informal communication

Communication arguably underpins most of the roles fulfilled by academic SNS, being a key part of any collaborative relationship, and communication of research being linked to scholarly impact. Communication through academic SNS ranges from informal (such as asking questions, keeping up with the field) to formal (self-publishing or open access to academic works). A corollary of web-mediated scholarly communications is the potential to trace the digital flow of information, quantify them and attempt to measure impact. This forms a major part of the body of research on academic SNS to date; this section will address less formal communication, while publishing and measuring impact which will be addressed in Section 2.3.

A small number of studies have addressed informal communication, in terms of questions and answers posed, via academic SNS. Jordan (2015a) used a grounded theory approach to analyse a random sample of 300 questions posed on Academia.edu, both in terms of the subject matter and types of questions posed. The subject matter of questions was found to be highly academically-focused; the most prevalent themes being questions relating to factual and conceptual questions, finding resources, promoting things, and research-related questions. In comparison to generic SNS (Morris, Teevan & Panovich, 2010), question types were more frequently focused on factual knowledge rather than seeking opinions (Jordan, 2015a). Since the data were collected, however, Academia.edu has discontinued the functionality to pose questions to the community.

The ability to pose and answer questions remains active at ResearchGate and two studies have focused upon this. Goodwin, Jeng and He (2014) examined the

effect of changes to the user interface design upon communication via the site. ResearchGate initially used a group-based structure to facilitate discussions; this changed to topic-based discussions, and more recently to Q&A style posts (Goodwin, Jeng & He, 2014). While sharing of information or opinions was equally likely in each mode, the move away from group-based discussions was marked by a lack of social cues and less courteous interactions (ibid.). In a related study, Li, He, Jeng, Goodwin and Zhang (2015) analysed a sample of 1021 answers posted on ResearchGate to examine characteristics of 'quality' answers (quality being defined by the number of upvotes received). The authority of respondents, posting quicker and longer responses were positively associated with quality. Objectivity and fact is again important in the academic SNS context, as answers containing social elements were negatively associated with quality (Li et al., 2015). Recently Alheyasat (2015) web scraped the questions and answers posed on ResearchGate, discovering that approximately four percent of the total registered users have ever posted a question or answer, and the distribution is steeply unequal and is claimed, without testing, to follow a power law (Alheyasat, 2015).

Although not strictly an academic SNS, the professional use of Twitter by academics is better documented, and the platform is used by a greater proportion of academics as a medium for informal communication than academic SNS (Van Noorden, 2014). After an initial lag, academics using Twitter has been rising consistently since 2009 and different disciplines and job positions are approximately equally represented (at least in terms of early adopters) (Priem, Costello & Dzuba, 2011). Veletsianos (2011) used a grounded theory approach to examine the subject matter of the most recent 100 tweets for a sample of 45 academics.

Eight themes were identified (Veletsianos, 2011):

(1) Information,

(2) Resource and media sharing,

(3) Expanding learning opportunities beyond the confines of the classroom,

(4) Requesting assistance or offering suggestions,

(5) Living social public lives,

(6) Digital identity and impression management,

(7) Connecting and networking,

(8) Presence across multiple online social networks.

In contrast to specifically academic SNS (c.f. Jordan, 2015a; Li et al., 2015), there is a greater social element and topics are not as strictly limited to factual academic content. However, the relative prevalence of the themes varies in practice; Segado-Boj, Chaparro Domínguez and Castillo Rodríguez (2015) surveyed members of the Communication faculties at Spanish universities about their use of Twitter, found that dissemination-related activities dominate. The theme of 'presence across multiple online social networks' is also notable, in that Twitter-based academic communication frequently directs people to profiles or resources on more formal academic SNS.

Despite active use by some academics, Twitter use remains far from standard practice, and the extent of use exhibits disciplinary differences (Mahrt, Weller & Peters, 2014). Holmberg and Thelwall (2014) explore disciplinary differences empirically via analysis of a large sample of tweets across five disciplinary areas, including Astrophysics, Biochemistry, Digital Humanities, Economics, and History of Science. Practices varied according to discipline; in Astrophysics, Biochemistry

and Digital Humanities academics were found to be using Twitter for scholarly communication, whereas the platform is little used in Economics and History of Science (Holmberg & Thelwall, 2014). Singh (2013) cautions that while Twitter remains under-used in academia, there is a risk that such differences may in fact promote cliques and create insular groups of academics. Stewart's (2015c) study of Twitter-active academics bridges the gap between Twitter as a platform and how its use is viewed in relation to academic practice and identity development. Communication is examined as part of the broader range of scholarly activities that Stewart concludes are being fostered and expanded through the site, allowing academics to build their professional networks in a manner that is public, cross-disciplinary, and with a focus upon their identity as individuals rather than in relation to affiliated institutions. As such, this study will be discussed in further detail in Section 2.4.

The studies reviewed here in relation to informal communication via academic SNS and academic uses of Twitter illustrate three gaps in the current literature. First, research to date has focused primarily upon data gathered from the platform rather than the perspective of academics themselves. Stewart (2015c) is an exception to this, although this is a single study and draws upon a small group of relatively high-profile users. Second, differences in use according to academic job positions have not been explored, when informal communication may be a key part of the use of the platforms as a personal learning network (Chapter 3). McPherson, Budge and Lemon (2015) reflect upon their use of Twitter in terms of an informal learning space in relation to their roles as academic developers; further work from a broader range of academic positions would expand this narrative. The efficacy of information gathered and exchanged in this sense will be

affected by the size and structure of an academics' network on the sites, which relates to the third gap; that is, that the network structure has not been explored.

2.3 Publishing and measuring impact

At the more formal end of the spectrum, the potential for academic SNS as platforms for open-access publishing has been emphasised in the rhetoric of Academia.edu and ResearchGate (Bower, 2012; Shankland, 2013). Academia.edu recently demonstrated the added value of using the site in terms of enhanced citations, which they attribute to the combination of open-access to publications with discoverability via its social network features (Niyazov, Vogel, Price, Lund, Judd, Akil, Mortonson, Schwartzman & Shron, 2016). However, the site has also encountered legal issues in relation to hosting copyrighted material. In 2013, Elsevier began to issue takedown requests for papers which infringed their copyright (Howard, 2013). While the major academic SNS aspire to compete with traditional publishers, awareness amongst academics of their role in open-access publishing is low (Duke & Jordan, 2011) and most users view the sites as online CVs (Van Noorden, 2014). Uploading content funded by Higher Education institutes to academic SNS may not meet funders requirements for open access publishing (RCUK, 2016) and also raises ethical issues (as academic SNS are for-profit ventures) which remain unexplored at present (Arènes, 2015).

The digital traces of academics' computer-mediated communication may provide alternative routes to measuring the impact of scholarly work, which has traditionally been measured primarily via bibliometric measures based on citation counts and journal impact factors. The field of altmetrics has developed in recent years to address this gap, seeking to harness data from digital environments (via

social media platforms such as academic SNS) in order to supplement traditional measures with networked information and impact upon non-academic audiences (Priem, Taraborelli, Groth & Neylon, 2010). Traditional metrics are widely used in tenure and promotion cases; while social media-based metrics are not commonly used at present, it has been suggested that this is likely to change in the future (Gruzd, Staves & Wilk, 2011). However, this is also dependent upon the accuracy of data present on academic SNS; by not actively engaging with their online profiles, academics risk an inaccurate picture of their scholarly outputs developing online (Murray, 2014; Ward, Bejarano & Dudás, 2015).

Research into the role of academic SNS in altmetrics, however, has largely focused upon calibrating online metrics against traditional definitions of impact rather than redefining impact. Nonetheless, if social media based altmetrics could offer as much accuracy as traditional metrics, their use could offer advantages in terms of speed of measuring impact and acting as an early indicator (citation counts being subject to the notoriously slow progress of the peer review and traditional publication processes).

As a tool for reference management combined with the affordance of academic social networking, Mendeley has been a ready source for such studies. Thelwall and Wilson (in press) looked at citation counts and Mendeley readership metrics for 332,975 medical research papers and found a significant correlation between the two. A similar study examined correlation between readership and citation counts in Humanities and Social Sciences; while both exhibited a positive correlation between citations and readership, the correlation was stronger in Social Sciences (Mohammadi & Thelwall, 2014). Despite the correlation, a proportion of papers which do not fit the trend remain, which may be due in part to differences in

use of either traditional metrics or Mendeley by different communities (Thelwall, in press). Thelwall and Sud (in press) examined temporal differences in Mendeley readership counts, reporting good potential for readership counts as early indicators of future citation counts.

Research has also begun to examine the potential for alternative measures of impact via the academic SNS affordances of associated Mendeley profiles. For example, this could be used to examine the extent of international readership (Thelwall & Maflahi, 2015) or uptake by different demographic groups (Mohammadi, Thelwall, Haustein & Larivière, 2015). Mohammadi et al. (2015) examined readership in terms of categories relating to academic job positions, finding that the majority of readers are early career academics (postgraduate students and postdoctoral researchers; note that use of academic SNS at different career stages will be discussed further in Section 2.4). Thelwall and Maflahi (2015) undertook a large-scale analysis of readership of papers via Mendeley across a range of disciplines, to examine whether readers of articles tend to be based in the same countries as their authors. The findings show that papers are indeed disproportionately read by those in the same countries as the authors (ibid.). This finding is also interesting in that it challenges a traditional assumption that international collaboration yields higher quality, higher impact research; it may simply be a case of having a greater potential readership (ibid.). Sud and Thelwall (in press) focus upon Biochemistry in order to test this statistically, which confirmed that whilst greater impact was correlated with larger teams, international partnerships did not have an effect. In combination with research to examine users' reasons for bookmarking papers, such approaches have potential to be

indicative of other types of scholarly impact, such as use in teaching (Mohammadi et al., 2015; Mohammadi, Thelwall & Kousha, 2016).

In addition to using information from profiles, the network structure of academic SNS offers possibilities for alternative ways of thinking about academic SNS and scholarly impact. Hoffman, Lutz and Meckel (2014, 2015) sampled the network of connections between 55 academics at a Swiss public university on the ResearchGate platform, in order to examine the relationship between social network analysis metrics and online activity or bibliometric measures. Results showed that more active participants showed greater network centrality; higher centrality was also related to measures of publication downloads on the platform. Centrality measures were also correlated with bibliometric measures of impact, and related to academic seniority (Hoffmann, Lutz & Meckel, 2014; Hoffman, Lutz & Meckel, 2015). Lutz and Hoffmann (2015) further expand upon this work by considering a larger sample (302) of academics at the same institution, examining the same network and bibliometric measures with the addition of webometric measures derived from coverage on social media platforms. Activity levels and bibliometric measures were again significantly correlated with centrality, while webometric measures were not (Lutz & Hoffmann, 2015).

Metrics derived from the social structure of academic SNS may have a useful role to play in development of a composite metric. The ResearchGate platform has attempted to create its own composite metric, the RG score, which claims to compute a score based not solely upon publications but also relationships and interactions (followers/following, questions/answers) via the site. While a composite metric offers potential advantages over traditional bibliometrics by including a wider range of activities, the journal impact factor still plays a

substantial role in how the RG score is calculated, as most academics do not use ResearchGate to post questions or answers (Alheyasat, 2015) and the score does not account for interactions on other platforms (Jordan, 2015b; Kraker & Lex, 2015). The rhetoric surrounding the RG score is also interesting in that it claims to be a measure of academic reputation, a concept which relates both to impact and identity (see Section 2.4) and has become more prevalent in recent years as a way of viewing the role played by academic SNS and their interactions (Nicholas, Herman & Jamali, 2015; Woolston, 2015). However, how to conceptualise and measure academics' online presence in these terms remains an open question; for example, Stewart (2015b) found that the perceived reputation and influence of academics was not related to metrics.

The theme of publishing and measuring impact is has received a greater focus in the empirical research literature in relation to academic SNS than more informal communication. There is an uneven representation of academic SNS platforms in the literature, however; availability of an API has made Mendeley a more fruitful site for research, despite being the least frequently used of the three main academic SNS covered in the Nature survey (Van Noorden, 2014; see Figure 1.2.1 and Appendix A). Overall, the studies suggest that academic SNS mirror, rather than alter, patterns of readership and measures of impact. This theme also includes the only other studies to examine network structure of academic SNS, via the ResearchGate platform (Hoffmann, Lutz & Meckel, 2014; Hoffmann, Luz & Meckel, 2015; Lutz & Hoffmann, 2015); more favourable network-based metrics were also correlated with more senior academics, also suggesting that the site preserves existing hierarchy. However, research in this theme is again mainly based on web-based, statistical data; the experiences of academics themselves is

lacking. Stewart's (2015b) Twitter-based study also touches upon this, by considering impact in terms of reputation of individuals, and concludes that metrics are not as important as identity-based recognisability factors. In this sense, reputation also provides a link to the next section, which will discuss the research in relation to demographic characteristics and identity.

2.4 Demographic characteristics and identity

The profile, as a virtual representation of self, is by definition a fundamental component of any SNS (Hogan & Wellman, 2014). As such, identity management is consistently highlighted as one of the main affordances of academic SNS (Bullinger et al., 2010; Espinoza Vasquez & Bastidas, 2015). However, the concept of identity is not straightforward and this is reflected in the research literature.

How identity is expressed online more generally has received a good deal of research and theorisation. Identity as understood through social media has focused upon identity as a performance online, as a selective reflection and enactment of an authentic self (Ellison, 2013). The seminal work of Erving Goffman (1959), which conceptualises identity as a performance, with different parts of the self being played out to different audiences, has been highly influential. Playing with fluid identity and pseudonymity were key concepts in taking identity online (boyd, 2008; Ellison, 2013; Turkle, 1996). However, this may be at odds with presentation of a professional, academic self through SNS.

A second key theoretical stance relating to identity theory is the question of whether identity is constructed as an individual or socially, through affiliation with others and communities, which relates to identity as a concept in social

psychology (Hogg & Vaughan, 2002). In terms of identity in this sense, SNS affords to opportunity to visualise and surface connections and communities, through the network of connections between profiles. The selective construction of connections has been identified as potentially a part of the performance of an individual's identity online; for example, Donath and boyd (2004) coined the term "public displays of connection" and Hogan and Wellman (2014) describe SNS in terms of "relational self portrait[s]". As such, personal network structures fostered by SNS occupies an interesting space in relation to online identity, being both an attribute of an individual and shaped by the social context they are embedded within.

As academic SNS profile fields have certain requirements about demographic information relating to academics (such as subject area, institution, and job position) as a minimum, this has provided structured data readily available via web scraping for studies which consider identity in terms of profile characteristics. This approach has been used to address questions about the extent of uptake of services by different demographic groups, and whether this reflects existing academic hierarchies. Almousa (2011) presents an analysis of 29,133 Academia.edu profiles drawn from four disciplinary areas (Anthropology, Chemistry, Computer Science, Philosophy), and four levels of academic seniority (faculty members, postdoctoral researchers, graduate students, independent researchers). Aspects of profiles were quantified and expressed numerically. This included the extent of profile completion, research interests, relationships (number of followers and number of people the user is following), following (number of nonhumans they are following – i.e. questions, papers), and activity frequency. Anthropology and Philosophy academics were found to be more active users than

Chemistry or Computer Science. Across disciplines, faculty members and postdoctoral researchers were most active, particularly in terms of uploading material. Postdoctoral researchers foster the greatest number of relationships (following others), while graduate students show the lowest levels of use.

Also focusing upon Academia.edu, Menendez, de Angeli and Menestrina (2012) collected and analysed data from 30,428 profiles, quantifying aspects of profiles and examining differences based on categorical factors including academic seniority, country development category, and university ranking category. In contrast to Almousa (2011), the number of questions asked and number of questions users are following did not differ statistically according to academic position (Menendez, de Angeli & Menestrina, 2012). These two items were however the exception; all other items demonstrated statistically significant differences based on position, with more senior academics consistently being more proliferate in each respect than more junior scholars. The analysis also suggested that the site preserves hierarchies based upon university ranking and country development (ibid.).

Thelwall and Kousha (2013) also examined whether Academia.edu reflects norms associated with academia or social media, through scraping and analysis of the profiles of all 30,167 academics associated with the research interest ‘Philosophy’. Results reflect those of Almousa (2011) and Menendez, de Angeli and Menestrina (2012): students post fewer items to their profiles and gain fewer views compared to faculty. Additionally, Thelwall and Kousha (2013) examined differences in terms of gender, on the basis that females have been shown to have an advantage in social media more generally, although female philosophers were found to have fewer profile views than males. This approach was extended to Law, History and

Computer Science, which revealed a mixed picture (Thelwall & Kousha, 2013). The authors therefore concluded that while academic norms prevail, Academia.edu reflects a hybrid of academic and social media norms (ibid.). Thelwall and Kousha (2015) follow up on the theme of whether academic SNS preserve existing hierarchies in the context of ResearchGate. ResearchGate metrics were found to correlate with university ranking scores; and while some countries are disproportionately using the site (examples include Brazil and India), others are not (notably China and Russia) (Thelwall & Kousha, 2015).

Disciplinary differences have also been reported in terms of the population of Academia.edu and ResearchGate; Arts and Humanities academics preferring Academia.edu, Natural and Physical scientists preferring to use ResearchGate, and Social Scientists using both (Jordan, 2014b; Van Noorden, 2014). Ortega (2015) studied a sample of over 6,000 academics (associated with his institution, Consejo Superior de Investigaciones Científicas) on Academia.edu, Google Scholar, Mendeley and ResearchGate. Similarly, for the category 'Humanities and Social Sciences', Academia.edu use is most prevalent, while the highest levels of ResearchGate use are seen in the Natural Sciences. Additionally, Google Scholar was notably more popular in 'Physical S&T' and 'Natural Resources', while Mendeley levels were relatively low across all subject areas.

Although profile-focused academic SNS are rich in demographic information, this may represent an impoverished view of academic identity online. Quantifying profile characteristics captures the product, but not the process, of identity construction and the dynamics that shape it. Academics are constrained in their definition of identity on academic SNS as the profile fields are set by the technical design of the platform (Kimmons, 2014). The studies reviewed here focus upon a

single platform, while academics are likely to construct their identity in different ways across the range of online tools that they use in relation to their academic practice (Veletsianos, 2016).

Bukvova (2011) proposed a framework to facilitate richer analysis of academics' online profiles across multiple platforms; the framework was subsequently applied to a sample of 48 European scientists in order to gain "a holistic understanding of online self-presentation" (Bukvova, 2012, p.341). This revealed several characteristic patterns in terms of how profiles are used (including: presence, visit card, knowledge base, personal journal, notebook and coffee house) (Ibid.). A divide in patterns emerged according to platform, with blog and microblogs being associated with the more interactive patterns and webpages playing roles associated with an online CV (ibid.). Notably, SNS were clearly aligned with the former.

While this approach offers advantages over those which focus upon one site and only at the content-unit level, it still essentially quantifies aspects of profiles and does not draw upon the academics' own perspectives. Considering the experiences of three academics with SNS more broadly (via generic sites such as Facebook), Veletsianos and Kimmons (2013) provide an insight into the tensions associated with developing an academic identity online. This is expanded in their 2014 study of 18 trainee teachers, which introduces 'acceptable identity fragments' as a concept to think about the multiple ways that their professional and personal identities are played out online (Kimmons & Veletsianos, 2014), and reiterates the challenges of tensions between them (Kimmons & Veletsianos, 2015).

Doctoral students and early career researchers (ECRs) have been identified as an academic demographic whose work and professional goals align well with the potential benefits of social media (Bennett & Folley, 2014; Coverdale, 2012; Esposito, Sangrà & Maina, 2012; James, Norman, De Baets, Burchell-Hughes, Burchmore, Philips, Sheppard, Wilks & Wolffe, 2009). Esposito (2014) focuses upon the role of social media in the transition from doctoral students to ECRs, drawing parallels with McAlpine and Akerlind's concept of identity-trajectory (2010) as a way of conceptualising academic identity development. Fransman (2013) examined how ECRs construct online representations of an academic identity, identifying benefits but also tensions in relation to institutional roles. Stewart's (2015c) study of Twitter-active academics emphasises the development of academic identities and networks as individuals rather independent of formal institutions. There is a gap in the literature here which calls for an examination of professional academic identity development facilitated by social media, mediated by different platforms, and the relationship between academic identity online and the existing literature on academic identity development more generally.

Academic identity online has been better researched and theorised in relation to other online media, notably academic homepages and blogs. The findings from these studies provide further insight into academic identity online, and a contrasting segment of the range of tools which academics use online. An examination of academic SNS in these terms would illuminate an under-researched part of this area.

Institutional or personal professional web pages may be considered a precursor to academic SNS in a sense in that the same information would be conveyed without the social networking element (a 'web 1.0'-type of technology). Thoms and

Thelwall (2005) present an early study based on 20 academics' university homepages. A typology of homepages was developed - comprising 'the nonentity', 'capitulator' and 'sycophant' - underscoring the perceived importance of power, surveillance and subjugation in the presentation of an academic self via institutional web space. Hyland (2011) presents an analysis of how academic identity is constructed online through a qualitative analysis of 100 academics' homepages. Academic seniority was identified as an important factor in the choice of text presented, "with assistant professors falling back on their qualifications and education in the absence of the publication and teaching records of their senior colleagues." (Hyland, 2011, p.289). Differences in the content and hyperlinks presented on homepages were also explored in terms of gender and discipline. Hyland (2013) built on this work, to compare identity construction in academics' institutional web pages with their personal homepages. While personal homepages offer much greater freedom in terms of design than institutional ones (McGowan, 2011), academic identity permeates the personal as well as institutional. The personal homepage is highlighted as playing an important role in constructing disciplinary identity, connecting with the broader community of the discipline rather than being tied to a particular institution (Hyland, 2013).

As an example of a 'web 2.0' technology, academic identity has perhaps been best explored through analysis of weblogs. The open and reflective nature of weblogs serve as a fertile area for developing academic identities (Ewins, 2005), both as an individual and in terms of developing groups (Dennen, 2009). Young, female academics may be more likely to engage with blogging (Nowson & Oberlander, 2006). Blogging can help negotiate transitions into academic careers (Ferguson, Clough & Hosein, 2010); and in turn, it is changing the nature of the

profession itself (Kirkup, 2010). Drawing upon Goffman's (1959) dramaturgical approach to identity and observations based on use of online media (primarily blogging, but additionally web pages and SNS) by communication scholars, Barbour and Marshall (2012) describe a typology of academic 'selfs'. The typology comprises the formal self, networked self, comprehensive self, teaching self and uncontainable self (Barbour & Marshall, 2012).

Despite the focus on the benefits of social media for less senior academics, in the context of academic SNS, demographic studies have indicated that doctoral students may be less prevalent (Elsayed, 2016), active (Menendez, de Angeli & Menestrina, 2012) or occupy more peripheral positions in the network (Jordan, 2014a). In studying academic SNS it would therefore be useful to:

(i) understand the role that they are playing for doctoral students in contrast to other online media, and

(ii) not focus upon doctoral students or early career academics alone but the broader spectrum of academic career stages.

Studies which consider identity in a holistic manner and beyond profile attributes are however rare and in contrast to other forms of social media, research on identity via academic SNS remains relatively superficial.

2.5 Supporting collaboration

Collaboration is a recurring theme in the affordances of academic SNS (Bullinger et al., 2010; Espinoza Vasquez & Bastidas, 2015). While there is a perception that collaborative research is desirable, the term is ill defined. Definitions focus upon multiple individuals working together to a specific end, sharing information and resources and building knowledge, which is an active process. Yet collaboration in

academia is typically examined via the products of this process, often through co-authorship of papers (Bukvova, 2010; see also Chapter 3).

Academic SNS have been identified as having particular potential in relation to collaboration as they combine a space for interaction and sharing information, along with the social network features to allow discovery of novel collaborators (Moeslein, Bullinger & Soeldner, 2009). Collaboration in the context of academic SNS can therefore be divided into two types. First, facilitating new productive working relationships via the platform between academics who share research interests but were previously unknown to each other; in this respect, research has focused upon understanding group formation and characteristics. Second, the digital traces of interactions taking place on the sites are a potential way of exploring the active process of collaborative research (the latter also being connected to informal communication, discussed in Section 2.2). However, there is a degree of resistance to use of online collaboration by researchers (Bullinger, Renken & Moeslein, 2011) and not all aspects of collaboration via academic SNS have been well-researched at present.

Formal groups on academic SNS as a proxy for collaboration have been best characterised via studying Mendeley. Oh and Jeng (2011) analysed the membership of 21,906 public groups on the platform, in order to examine their size and the extent of interdisciplinary membership. Group size was found to follow a highly skewed distribution, while group size correlated with an increase in number of disciplines present. Most groups have only one member (Oh & Jeng, 2011), which may be a cautionary note against the utility of using groups as a proxy for collaboration. Jiang, Ni, He and Jeng (2013) further explore the influence of academic discipline upon group membership by using a network analysis

approach based upon the number of members in common between two groups. Gao, Hu and Jiang (2015) provide an update to these studies via analysis of an updated scraped Mendeley data set. The observations made by Oh and Jeng (2011) in relation to group size persist; Gao, Hu and Jiang (2015) also examined the number of papers shared in groups, which also exhibit a strong skew toward smaller collections.

Two studies have extended this work to include social factors in relation to Mendeley groups. Jeng, He, Jiang and Zhang (2012) coded a sample of public Mendeley group descriptions (529) in terms of categories derived from social group theories. The most frequent types of description were 'directive descriptions' (52.3%), followed by 'affective-emotional descriptions' (14.6%), 'achievement-oriented descriptions' (13.1%), and 'self-presented descriptions' (6.3%) (Jeng et al., 2012). All except self-presentation were significantly associated with group growth in terms of members, while all except achievement-oriented were significantly associated with growth in terms of number of papers (Jeng et al., 2012). In order to complement the web scraped studies, Jeng, He and Jiang (2015) conducted a survey of members of public groups on Mendeley in order to explore their reasons for participation in groups. 146 responses were received, which showed a range of reasons for group participation, although general willingness to engage socially via the site remained low (Jeng, He & Jiang, 2015).

It should be noted however that while Mendeley provides an opportunity to examine collaboration in terms of groups by virtue of academics being able to explicitly form groups, and provision of an API which facilitates access to the data, neither are standard features of academic SNS (Espinoza Vasquez & Bastidas, 2015). While the larger academic SNS (Academia.edu and ResearchGate) do not

provide tools to form formalised groups, community structures are implicit in the sites via the social networks of followers and following between profiles. This may provide a more authentic representation of collaborative relationship, yet remains under-explored. As a pilot to the present study, Jordan (2014a) sampled the networks of Open University-affiliated academics present on Academia.edu, Mendeley and Zotero (the pilot study will be described in further detail in Chapter 3). Although the Zotero sample included too few connections to be able to visualise a network, trends in network structure were present in both the Academia.edu and Mendeley networks, indicating that subject area and academic seniority play a role in network structure (Jordan, 2014a). Although this study was limited to one HEI and exploratory in nature, its results have been corroborated at another institution (Hoffman, Lutz & Meckel, 2014; Hoffmann, Lutz & Meckel, 2015) and shows the potential for examining community structures via network analysis of academic SNS.

The research literature relating to academic SNS in terms of collaboration demonstrates two limitations at present. First, the majority of studies are restricted to a single platform (Mendeley) due to accessibility of data; this issue was also present in the discussions relating to publishing and impact (Section 2.3), but it is compounded here by the fact that group formation is not a function which is present on the leading academic SNS platforms (Academia.edu and ResearchGate). Secondly, analysing group characteristics as a proxy for collaboration has its limitations in that only a small proportion of users join groups, and assumes that all members of the group have a similar relationship to it. Broader questions remain about whether academic SNS do constitute active communities of researchers in the sense of fostering collaboration. Jamali,

Russell, Nicholas and Watkinson (2014) posed this question via a questionnaire-based study, concluding that the majority of users of academic SNS use them in passive ways rather than as active sites for collaboration. Mirroring the Nature survey results (Van Noorden, 2014), generic rather than academic social media tools were found to be used in more active ways (Jamali et al., 2014). Alternative ways of conceptualising and exploring collaboration via academic SNS would be beneficial; for example, using network structure (Hoffmann, Lutz & Meckel, 2014; Hoffmann, Lutz & Meckel, 2015; Jordan, 2014a). However, no work has sought to validate the meaning of connections in the context of academic SNS. Once again, studies which bridged the gap between web-based data and the perceptions of the academics involved are wanting.

2.6 Summary and RQs

There is a growing body of empirically-based literature related to academic SNS, and the professional use of generic SNS by academics. In this chapter, the literature was reviewed in terms of four major themes: communication; publication and impact; demographics and identity; and collaboration. The choice of themes was both informed by research-derived typologies of affordances of academic SNS (Bullinger et al., 2010; Espinosa Vasquez & Bastidas, 2015), and emergent themes from the body of literature. By mapping the body of literature in these terms, concepts which link the themes were uncovered (illustrated in Figure 2.6.1).

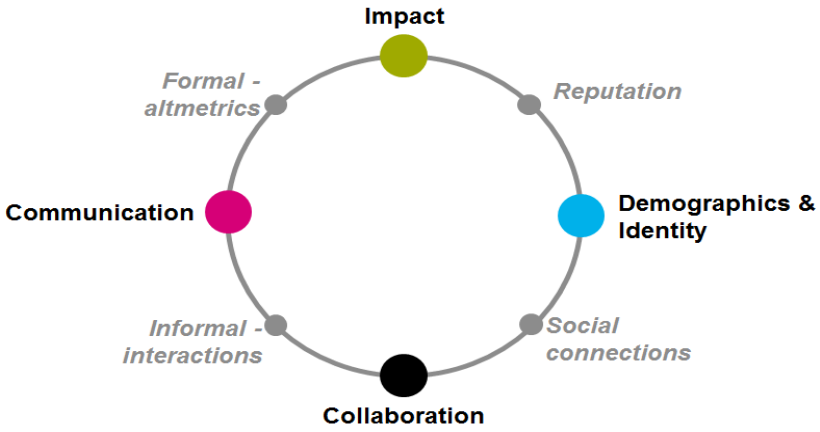


Figure 2.6.1: Pictorial representation of the themes in the academic SNS research literature and concepts which link them.

The themes and links between them are underpinned by dynamics of relationships within academia and academic identities. However, there are limitations to the extent to which this has been examined empirically at present.

First, the majority of studies examine only one platform (frequently Academia.edu, Mendeley, ResearchGate or Twitter) in isolation, while there are a wide range of social media platforms which academics engage with (Chapter 1). There is evidence that different platforms are used for contrasting, but still professional, purposes; key examples being the use of Twitter for active interactions such as discussions, and academic SNS such as Academia.edu and ResearchGate as more static online CVs (Bukvova, 2012; Van Noorden, 2014).

Second, the defining characteristic of academic SNS - that is, the network of connections - has received little attention, yet the network structure may play an important role in the extent to which the themes are successfully facilitated in practice. For example, network structure can affect the diffusion of information through networks and reveal social roles played by different participants. Network analysis has been applied extensively in the context of citation and co-authorship

networks in order to examine the structure of academic disciplines and collaboration (see Chapter 3). Further focus upon the network structure fostered by academic SNS may yield insights into all aspects of the research themes.

Third, research methods deployed to examine academic SNS have been dominated by automated extraction of attributes and contents from profiles and groups. Such approaches assume equivalence between the units of measurement - for example, bookmarked papers, connections to others, membership of groups - which does not account for the motivations of the participants. The views of the academics involved are rarely sought. This is of particular importance when considering issues which relate to identity and reputation, which are not easily expressed via metrics (Stewart, 2015b). A notable exception is the recent research undertaken by Ahmad Kharman Shah (2015), whose doctoral research examined how academics use Twitter in their professional practice through semi-structured interviews with 28 academics at the University of Sheffield.

Nine types of Twitter use were identified, (Ahmad Kharman Shah, 2015, p.ii) including:

(1) communication;

(2) dissemination;

(3) pedagogical activities;

(4) building relationships and maintaining networks;

(5) performing digital identity;

(6) taking micro-breaks;

(7) information seeking and gathering;

(8) learning, and

(9) coordinating or amplifying other social media and website use.

The nine themes echo the uses highlighted for Twitter in the Nature survey (Van Noorden, 2014) and will be discussed further in relation to the findings in the discussion.

In order to help address these gaps and further the research agenda related to academic SNS, the present study will focus upon the network structures fostered by such sites. By discussing the network structures with participants, the connection will be explored between the networks and the processes which shape them, in relation to the professional practice of academics, and expanding upon the themes reviewed in the present chapter. In light of this, the study will address the following over-arching question:

- How are social networking sites (re)shaping academic roles and relationships?

This is underpinned by the following questions:

- RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?
- RQ2: How do academics construct and understand their ego-networks?
- RQ3: Does the structure and/or role of the network differ in nature according to academic career trajectories?

In the next chapter, the rationale for examining network structure and benefits of adopting a social network analysis-based approach will be discussed.

3. Taking a social network perspective

In Chapter 2, the existing body of research in relation to academic SNS was reviewed, and the lack of focus upon one of the fundamental aspects of SNS - that is, the network - highlighted. This chapter will set out the rationale for examining academic SNS in social network analysis terms, and the decision to focus upon networks at the ego-network level.

Classic insights yielded from social network analysis in other contexts will be introduced, and existing applications of social network analysis in the context of Higher Education discussed. Drawing upon this and the themes in Chapter 2, the present study and RQs will be set in the broader research context and provide a bridge between the existing research literature and Methodology (Chapter 4).

3.1 Insights into social structures via social network analysis

Social network analysis (SNA) originated in early twentieth century Sociology (Wasserman & Faust, 1994). SNA is not a single approach but rather a toolkit of different metrics and analyses which can be used in contexts where social relations can be conceived of as links between individuals (Borgatti, Mehra, Brass, & Labianca, 2009; Kadushin, 2012; Wasserman & Faust, 1994). SNA occupies an interesting space, with both qualitative and quantitative roots; as a result, as Peter J. Carrington puts it, SNA “itself is neither quantitative nor qualitative, nor a combination of the two. Rather, it is structural” (Carrington, 2014, p.35).

By viewing social relations as a network, novel insights can be gained in terms of the structure of communities and social roles (Borgatti et al., 2009). The best known examples relate to relationships between network structure and the flow of

information within networks, making links between network structure and social capital (Burt, 2000). In his seminal work, Granovetter (1973) outlined the importance of the role of ‘weak ties’ as sources of novel information, illustrated empirically by advantages in terms of getting jobs. Burt (1976, 2005) further elaborated the relationship between social network structure and benefits to individuals via the concept of ‘structural holes’. A structural hole exists in a network when there is a lack of social connections between different communities within the network. If structural holes are present, there is potential therefore for individuals to adopt the role of a ‘broker’ by creating a bridge between the otherwise unconnected communities and exploit that position. Being a broker affords benefits in terms of social capital via information benefits (e.g. access to new ideas) and control benefits (e.g. playing off contacts against each other in salary negotiations) (Burt, 1992; Burt, 2005).

Thinking about internet-based interactions in terms of strong and weak ties, Haythornthwaite (2002) argues that there may be particular benefits afforded by the medium in order to support and reinforce weak ties. Strong ties would also stand to benefit, although weak ties may be lost if the online network replaces, rather than complements, a pre-existing network (Haythornthwaite, 2002). The importance of online media channels in reinforcing strong ties was subsequently shown empirically (Haythornthwaite, 2005). It should be noted however that while SNA has been readily adopted by researchers analysing social media, the nature of online social networks is different to the context in which much of SNA was developed (Kane, Alavi, Labianca & Borgatti, 2014). Although follower-following type relationships provide a ready source of nodes and edges, the meaning and significance of each relationship will differ and equivalence cannot be assumed.

For this reason, mixed-methods approaches to SNA (Dominguez & Hollstein, 2014) may be of particular utility in the context of studying social media networks. Nonetheless, concepts from classic SNA have transferred and provided insights via studies of social media.

There is a large body of empirical studies which suggest that benefits related to the concepts of tie strength (Granovetter, 1973), structural holes and brokerage (Burt, 2005) hold in social media environments, and can be further developed due to the availability of data. For example, users with more diverse Twitter networks are exposed to more ideas (Parise, Whelan & Todd, 2015). Also focusing upon Twitter networks, Kang and Lerman (2015) demonstrate that access to novel information is not defined solely by network structure but rather a combination of structure and user effort. Individuals with larger, more diverse networks were exposed to a greater diversity of topics, but the most active users received a high level of information regardless of network size (Kang & Lerman, 2015). Benefits are by no means restricted to information; for example, Ellison, Vitak, Gray and Lampe (2014) link Facebook-based social networking to bridging and bonding social capital. However, as noted in Chapter 1, social media comprises a wide range of online platforms. Considering only one in isolation can lead to over- or under-estimation of social capital (Hristova, Panzarasa & Mascolo, 2015).

3.2 Applications of social network analysis in Higher Education

Considering academic SNS through SNA would allow the sites to be explored in relation to social capital, giving novel insights into the roles being played by academic SNS and whether they are reshaping scholarly practices and relationships (Chapter 1).

In the context of Higher Education, existing applications of SNA take three main forms, examining:

(i) citation networks,

(ii) web link mining, and

(iii) personal learning networks.

As discussed in Chapter 2, few studies have examined social network structures for academics online.

In a seminal paper, Price (1965) studied citation networks of academic papers. The network demonstrates a heavy-tailed degree distribution; that is, there is a small proportion of very large networks, and a substantial proportion of the networks are small (heavy-tailed or steeply-unequal degree distributions will be discussed in further detail in Chapter 6, and an example is shown in Figure 6.2.1.1). Such a distribution of network sizes has subsequently been established as a hallmark of social networks in a range of different settings (Barabasi, 2011). While citation analysis has gone on to become entrenched in the measurement of research impact, further studies have built upon this work in order to examine the structure of collaboration, via co-authorship, in different disciplinary settings including Economics (Goyal, Van der Leij & Moraga-Gonzalez, 2004), Physics (Newman, 2001), Biology, Physics and Mathematics (Newman, 2004). Sun, Lin, Xu and Ding (2015) have recently extended work on co-authorship networks and claim to be able to model and predict collaboration by combining network structure and attributes of individuals. However, these approaches also bring limitations; for example, co-authorship networks may privilege more senior academics (academics are not part of the network in this sense until they have published

research). Co-authorship networks focus upon only one type of output from the research process rather than capturing the dynamics of collaboration in practice. There is a question of whether a citation is a social tie, and it may be more fitting to describe citation networks as information networks rather than social networks (Newman, 2003). It is possible that by considering academics' networks and interactions via SNS, some of these limitations could be addressed.

Webometrics-based approaches (Thelwall, 2009) have seen the application of SNA to mapping links between academic web pages. Studies have focused upon links between institutional pages at different levels of network sampling. Examples at an international level include mapping web links between domains in the Nordic (Danish, Finnish and Swedish) (Ortega & Arguillo, 2007) and Chinese (Yang, Liu & Meloche, 2010) Higher Education sectors, to gain an insight into the relative representation of different communities and network topology. To examine network structure in terms of collaboration, Stuart, Thelwall and Harries (2007) analysed links between UK Higher Education institutions and other bodies. While the findings showed some potential for web link analysis as an approach to measuring collaboration, most links did not reflect a collaborative relationship (Stuart, Thelwall & Harries, 2007). At the level of the individual academic, a pair of studies used SNA to analyse links in the Stanford University network. Adamic and Adar (2001) examined links between individuals academic webpages; subsequently, a similar study was conducted based on an early Facebook-style network at the university (Adamic, Buyukkokten & Adar, 2003). However, there has been a notable lack of examination of network structure in the following years despite the uptake of social media by academia.

A recent development has been the application of SNA in relation to academics' personal learning networks. SNA has been used more extensively by the Networked Learning community in relation to undergraduate students and formalised study (Haythornthwaite & De Laat, 2012); this will not be reviewed here, as the present study is focused rather upon academics themselves and their relationships with academia. Oliveira and Morgado (2014) define personal learning networks as a "set of connections between individuals, with the objective of enhancing mutual learning through feedback, ideas, documentation, new contacts, in order to obtain a network of learning and acquire new knowledge" (Oliveira & Morgado, 2014, p.473); as such, SNS may provide a mechanism for tapping into a broader network of connections. Academics draw upon personal learning networks for information and support in relation to a wide variety of teaching practices (Pataraia, Margaryan, Falconer & Littlejohn, 2013). SNA has been applied to academics' personal learning networks in order to elucidate key learning connections (Pataraia, Margaryan, Falconer, Littlejohn & Falconer, 2014; Rienties & Hosein, 2015). However, academics' personal learning networks through social media have not been examined to date; an exploration of networks structures facilitated by SNS would provide a contribution in this area.

3.3 Pilot study

When planning a SNA-based study, which networks to sample and at what level to define the network (e.g. whole network, particular communities, or the immediate network of connections around a particular individual) are key considerations (Prell, 2012). As a precursor to the main study, the pilot project helped inform these decisions. The full pilot study has been published in First Monday (Jordan,

2014a); a summary is included here to present key findings, which shaped the approach to SNA for the main study.

The pilot study focused upon Open University-affiliated academics and their use of academic SNS, using a mixed-methods SNA approach. It set out to explore academics' levels of use and reasons for using academic SNS through an online survey, and also examined the network structure of connections between Open University-affiliated academics on three academic SNS (Academia.edu, Mendeley, and Zotero) using SNA. For the three platforms, profiles were selected for inclusion on the basis of stated affiliation with the Open University.

The key conclusions from the pilot study were as follows:

- Network analysis suggested that position within the network is significantly linked to job position, with more senior academics enjoying more connections (higher degree) and occupying more central positions within the network (higher centrality).
- Communities (clusters of more tightly connected academics) appear to be associated with different subject areas.

Two key decisions were made for the design of the main study as a result of the findings from the pilot study. First, the pilot study suggested that network structure was linked to development of an academic identity, as more senior academics occupied more central positions within the networks, and subject areas defined communities. As such, this underscored the importance of exploring the networks from the perspective of individual academics and informed the decision to sample networks at the ego-network level (that is, sampling an academic, their followers, following, and any connections that exist between academics in this sample).

Second, the survey responses and feedback from academics through presentation of results based on the network analysis emphasised that academic SNS are just one type of online network through which scholarly professional practices are enacted. The three networks in the pilot project showed similarities in terms of the relationship between job position, subject area, and network structure. Sampling from more than one platform would be beneficial to gain a fuller picture of the networked academic, but focusing exclusively upon academic SNS may give limited returns as trends in network structure are upheld across different platforms. Therefore, in addition to the result of the large-scale Nature survey (Van Noorden, 2014) which were published in the same year, the decision was taken to sample pairs of ego-networks per participant in the main study. Each pair comprised an academic SNS (Academia.edu or ResearchGate) and Twitter, as the platforms are amongst the most popular ones used by academics in their professional life, for contrasting purposes (NPG, 2014; see Chapter 1).

3.4 Summary

In the preceding chapters, the context for the present research study has been introduced. Social media has been identified as a channel through which digital scholarly practices can be enacted. The development of SNS specifically aimed at academics has been an explicit move to try to harness the popularity of SNS and translate their affordances into benefits for the Higher Education community. However, the role that such platforms are playing in practice is currently an active area of research.

Analyses based on content analysis or bibliometrics have been predominantly used to date. Multi-platform studies and the views of academics themselves are

notably absent. The defining characteristic of academic SNS has not been addressed; that is, the ability to make and navigate through connections between profiles. As Hogan and Wellman put it, SNS profiles represent a “relational self-portrait” (Hogan & Wellman, 2014, p.53). What is the significance of these “public displays of connection” (Donath & boyd, 2004) in the context of being an academic?

Considering academic SNS in SNA terms offers the potential to make theoretical connections to social network structures more generally, and complement the lack of personal connections in existing applications of SNA to the Higher Education sector. To provide a more holistic view, the study will examine academics’ networks on both academic SNS (Academia.edu or ResearchGate, as the main platforms at present) and Twitter. Network structures will be elucidated and their meaning foregrounded by co-interpretive interviews with participants, in order to gain insight from the academics’ point of view. Sampling to reflect a range of job positions and subject areas will ensure a range of different points of academic ‘identity trajectories’ (McAlpine & Akerlind, 2010) are represented, which will provide a more detailed insight into issues of academic identity mediated via academic SNS than profile attributes alone. Mixed methods SNA as a methodology and the practical details of the research methods and how the study was executed will be discussed next, in Chapter 4.

4. Methodology

The preceding chapters set out the research context for the study; the existing body of related research literature was critically assessed, and the RQs for this study derived. This chapter will focus upon the research methods used to address the RQs.

A mixed-methods SNA approach was used, which combined an online survey, social network data, and interviews with participants. An overview of the relationship between methods and the RQs is shown in Figure 4.1.

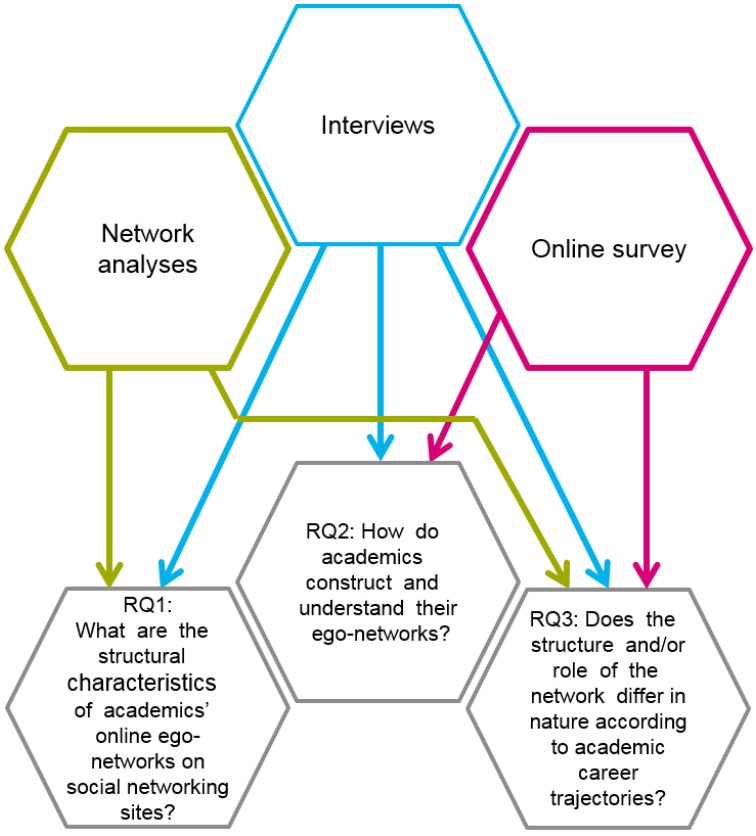


Figure 4.1: Overview of how the research methods address the RQs.

This chapter presents the rationale for the methodology and research methods selected in order to address the RQs, in addition to considerations about their design and execution in practice.

4.1 Philosophical underpinnings and theoretical perspective

In order to address the RQs, it is essential to select an appropriate methodology and research methods. Methodologies are bound with accompanying ontological and epistemological assumptions, reflecting different research paradigms and theoretical underpinnings (Crotty, 1998; Gilbert, 2001). It is often argued that these issues must be surfaced in order to ensure consistency within research designs (Taber, 2007). However, it is also argued that paradigms represent false distinctions and methodological approaches are independent of philosophy; as such, researchers should base choices upon which methods would best serve to address the RQs (Bryman, 2006; Symonds & Gorard, 2010).

To recap, the questions guiding this study are as follows:

- RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?
- RQ2: How do academics construct and understand their ego-networks?
- RQ3: Does the structure and/or role of the network differ in nature according to academic career trajectories?

Ontological assumptions focus upon the nature of reality and are closely related to epistemological issues, which relate to the nature of knowledge and hence what can be known about reality (Blaikie, 2009; Cohen, Manion, & Morrison, 2007; Twining, 2009). By considering the philosophical underpinnings of the RQs,

theoretical perspectives can be considered in order to make links between the philosophy and execution of the study, “informing the methodology and thus providing a context for the process and grounding its logic and criteria” (Crotty, 1998, p.3). The relationships between contrasting ontological, epistemological and theoretical perspectives are summarised in Figure 4.1.1.

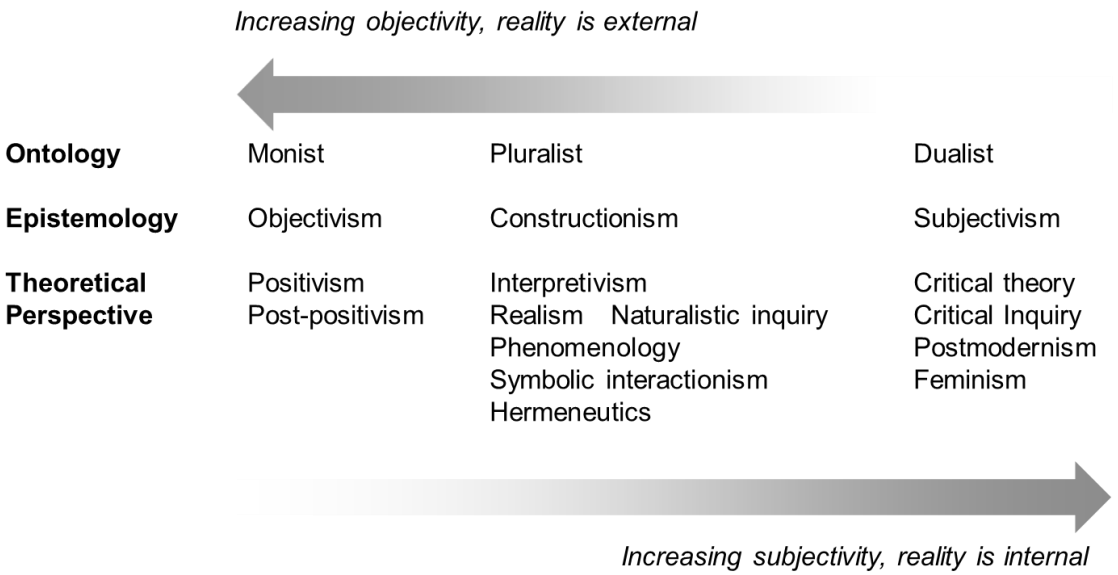


Figure 4.1.1: Summary of major theoretical perspectives in relation to underpinning ontological and epistemological stances.
After Blaikie, 2009; Cohen, Manion & Morrison, 2007; Crotty, 1998; Gray, 2009; Twining, 2009.

The RQs are complex and do not sit easily within a single research paradigm. While examining network structure is almost positivistic in nature – assuming that these structures are definite and there to be discovered – this is only part of the study. A greater emphasis is placed upon how the meaning of the networks is constructed: how they are viewed by the participants themselves, and whether there are trends according to different factors within the socially-constructed context of academia. To study the network structures purely objectively in isolation would deny the academics’ agency behind their creation and their significance; on the other hand, to focus entirely upon the academics’ perceptions about their

networked identity online would neglect the networked element (which is a gap in the literature that this study is particularly intended to address; see Chapter 2).

Considering the RQs in these terms, the questions are complex and draw upon multiple traditions. It is necessary to acknowledge and surface these issues so a cohesive and complementary research design may be implemented, balancing and addressing any tensions. In terms of a theoretical perspective, phenomenology recognises that “any attempt to understand social reality has to be grounded in people’s experiences of that social reality” (Gray, 2009, p.22). The RQs here foreground academics’ perceptions of their network structures, so a phenomenological perspective fits well; describing a phenomenological stance, “such experience will be filtered through one’s unique life experience [...] one cannot get away from that subjective filtering of one’s unique and personal experience, feeling and understanding” (Pring, 2000, p.100). Within a phenomenological research paradigm, it is appropriate for the researcher to seek to understand what is happening in the context of study, focusing on meanings, and take an inductive approach to the data (Easterby-Smith, Thorpe, & Lowe, 1991; Gray, 2009).

4.2 Mixed methods social network analysis as a methodology

The combination of perspectives in the RQs calls for a methodological approach which can both define the object of study (the network) and account for its interpretation by participants. RQ1 is an objective question, concerned with network structure and is necessarily quantitative, while the structures are interpreted and given subjective meaning by participants and the researcher in

addressing RQ2, which would suggest a qualitative approach. RQ3 will be addressed by examining differences across both analyses.

There is a relationship between the RQs in that RQ1 must be answered – establishing the network structures – before they can be interpreted. SNA is a specialist approach which is uniquely placed to address this question, being predicated upon mapping social connections between individuals and characterizing network structure (Borgatti et al., 2009; Kadushin, 2012; Wasserman & Faust, 1994). While viewing social relationships as networks can provide insights, the agency of participants is not accounted for. Networks provide a snapshot of relations but do not directly examine the processes which led to their creation. These limitations are particularly relevant for the present study, reflecting the goals of RQ2.

Mixed methods SNA is a research methodology which seeks to ameliorate the limitations of traditional SNA by combining it with other research methods in order to gain a more complete understanding from the participants' viewpoints (Edwards, 2010). Hollstein (2014) defines mixed methods network studies as those which "are based on both quantitative, numerical network data – that is, describing nodes and relations – and qualitative textual data", making use of both quantitative and qualitative approaches to analysis, and integrating both data sources together (Hollstein, 2014, p.11).

4.3 Research design

As the complexity of the RQs called for a mixed methods SNA approach as a methodology, a combination of research methods was required. Three methods were employed: first, an online survey; second, ego-network analysis; and third,

co-interpretive interviews. The relationship between the methods, analyses, and RQs is shown in Figure 4.3.1.

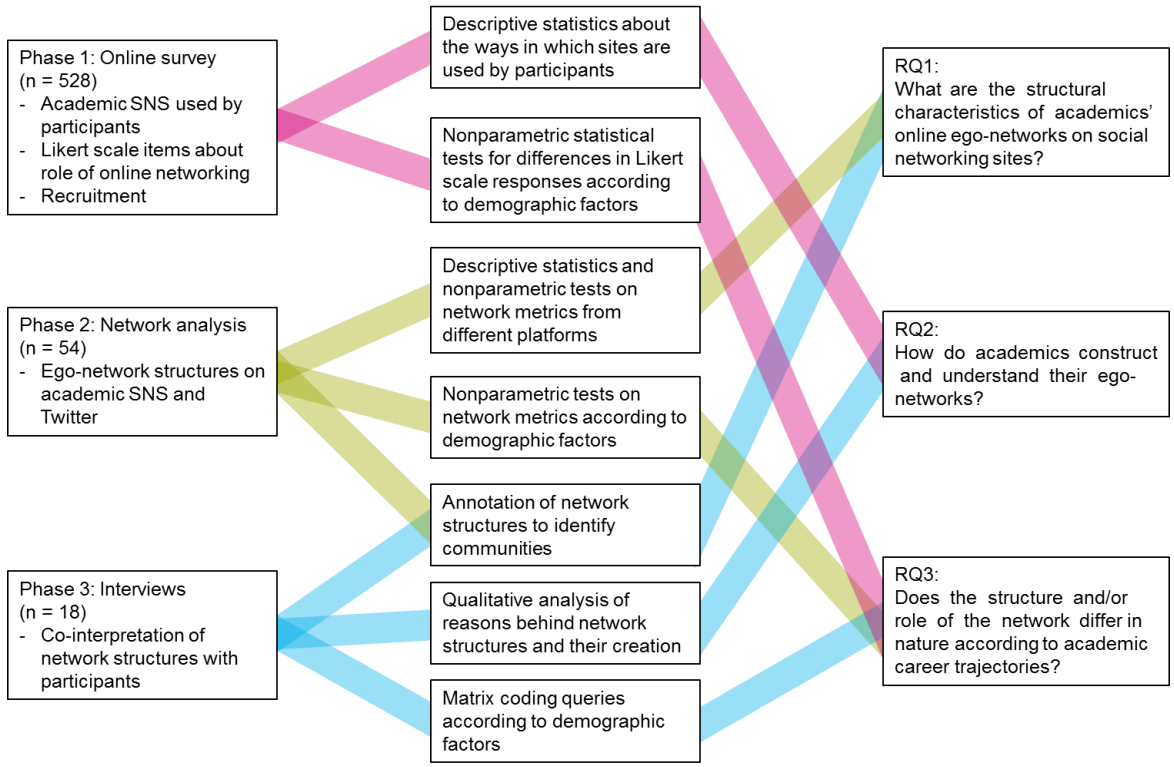


Figure 4.3.1: Summary of the research design and relationship between the research methods (left column), analysis (middle column) and RQs (right column).

4.3.1 Survey

An online survey was implemented as the first phase of the research process. The survey had two goals: first, as a mechanism for recruiting academics to take part in follow-up activities including network data collection and interviews; and second, to generate a base-line of data about academics' use of SNS, which the individual case studies could be set within. With these goals in mind, the advantages of surveys as a research tool outweighed their limitations (summarised in Table 4.3.1.1) as an initial stage in the research process.

Table 4.3.1.1: Advantages and disadvantages of survey-based research methods. After Bell, 2005; Cohen, Manion & Morrison, 2007; Denscombe, 2007; Oppenheim, 1992; Sapsford, 2007.

Advantages	Disadvantages
A greater quantity of data may be collected from a larger sample in less time	Poorly-constructed surveys may cause loss or non-collection of data, or non-completion
Greater reliability due to consistency of format for all participants	Participants may feel constrained by the questions
Reduced risk of researcher bias	Cannot check comprehension of question or offer alternative phrasing
Easier access to participants – negotiating physical access or appointments are not required	Difficult to establish rapport with participants

The survey comprised three sections: first, demographic information about participants and the platforms they use, to allow for analysis and sampling according to job position and discipline; second, Likert-scale items about the ways that they use SNS; and third, introducing the potential network analyses and gaining an indication of whether respondents would be prepared to participate in these activities. The survey was conducted using Bristol Online Surveys (http://www.onlinesurveys.ac.uk). Screen captures of the full survey structure as presented to participants are shown in Appendix B.

The first (demographic) section comprised the following items:

- Name (optional).
- Email address (optional).
- Current university (optional).

- Which subject area do you work in? (Subjects were based on the HESA classification scheme and presented as a radio button list. For analysis, subjects were subsequently categorised into five disciplinary areas – Arts and Humanities, Formal Sciences, Natural Sciences, Professions, and Social Sciences – as outlined in Appendix C).
- Which best describes your current position? (Options included: graduate student; academic support; researcher; lecturer; professor; other (please specify)).

In the second section, a list of SNS were presented and participants asked to indicate their use on the following scale: ‘most days’, ‘most weeks’, ‘monthly’, ‘rarely (less than once a month)’, ‘I created a profile at the site but have not used it since’, or ‘N/A’. The opportunity to add comments in response to any of the sites was presented. The sites listed included Academia.edu, a blog, Diigo, Facebook, Google+, LinkedIn, Mendeley, ResearchGate, Slideshare, Twitter and Zotero.

The inventory of Likert scale items, and the existing studies which informed them, are shown in Table 4.3.1.2.

Table 4.3.1.2: Inventory of Likert scale items included in the survey.

Item	Rationale and basis
I see my profile as an online business card	Characterisations of the role of profiles on academic SNS (Bukvova, 2012; Veletsianos & Kimmons, 2013).
Developing my online identity is important to me as an academic	
I present my identity in different ways on different sites	
My online academic and personal identities are separated	
I use my profile as a research journal	
I feel I should probably do more to promote my research using online networks	
I don't think having a professional profile on an online network is very important for a researcher	
I use social networking sites to support my teaching activities	
Social networking sites are a useful way to support working in collaboration with other researchers	Collaborative aspects of academic social networking – draws upon Jeng et al., 2012; Oh & Jeng, 2011 – but focus upon individuals rather than groups.
I use social networking sites to discover peers working in my field of research	
I actively interact with other academics via social networking sites	
I use social networking sites to discover individuals outside my field of research	
Attracting collaborators	
I follow people as a way of staying in touch with people I used to work with	Exploring trends in network structure (Jordan, 2014a).
If someone follows me, I follow them back	
I follow people who I would like to work with in the future	
I only follow people who I know personally	
I use social networking sites to track metrics relating to interest in my work	Dissemination – draws upon Nature survey (NPG, 2014).
Social networking sites are a good way of promoting my own academic publications	
Sharing authored content	
Social networking sites are a good way of finding out about new publications of interest	Gaining information – draws upon Nature survey (NPG, 2014) and question use (Almousa, 2011; Menendez, de Angeli & Menestrina, 2012).
Social networking sites allow me to draw upon a wider community of expertise when I need help	
Being able to ask questions of the online community is important	
Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	

Item	Rationale and basis
Social networking sites are useful to discover job opportunities	Careers-related issues – draws upon Nature survey (NPG, 2014) and differences according to job position (Almousa, 2011; Menendez, de Angeli & Menestrina, 2012)
Having a profile will enhance my future career prospects	
Raising your personal profile in the research community	
Raising the profile of your work in the research community	
Attracting funding	
Attracting future employers	

Note that nine questions were included verbatim from a similar survey undertaken by Nature Publishing Group (NPG, 2014); these were included in order to be able to assess the reliability and validity of the survey instrument against responses from a larger sample population (Section 4.4).

Sampling posed an immediate challenge for the study, as sampling techniques designed to ensure a representative sample rely upon knowing the probability of inclusion (Tashakkori & Teddlie, 2003), which is critical for confirmatory studies which seek to test hypotheses (Arber, 2001; Teddlie & Yu, 2007). However, the population which the study could potentially draw upon – that is, academics who use social media – is not one which is possible to know the full extent of. As such, an opportunistic sampling approach was used for the survey (Teddlie & Yu, 2007). It was publicised by the researcher across a number of online social media platforms (specifically Academia.edu, LinkedIn, ResearchGate and Twitter), and others encouraged to share the information, in order to gain as many responses as possible. The survey was launched on 19th November 2014, and remained open until 3rd February 2015; during this period, a total of 528 responses were achieved.

Survey data analysis was undertaken using SPSS. The survey generated two types of data:

(i) categorical data, in relation to demographic factors and familiarity with particular sites; and

(ii) ordinal data, from Likert scale items about the ways that academics use online social networking in general.

Descriptive statistics were used to report trends in the data overall. As Likert scales generate ordinal data, the median was used as a measure of central tendency, and the range to describe the spread of data (Denscombe, 2007; Jamieson, 2004). For the same reason, parametric statistical tests are not an appropriate tool for analysis of Likert scale data (Bell, 2005; Denscombe, 2007; Jamieson, 2004). Differences between subsets of demographic groups – including discipline, and job position – were therefore examined using nonparametric Kruskal-Wallis tests (Field, 2009; Jamieson, 2004). Pairwise Mann-Whitney U tests were used as post hoc tests to identify which categories the statistically significant differences could be attributed to (Field, 2009). When administering post hoc tests, the Bonferroni correction was used to adjust the value of α to mitigate the increased risk of Type I errors when carrying out multiple tests (Field, 2009). For tests concerned with job position (four categories), the adjusted α is 0.0083; for tests using discipline (five categories), the adjusted α is 0.005.

4.3.2 Social network analysis

As the RQs are concerned explicitly with elucidating network structure, SNA methods are required. The advantages and disadvantages of SNA as an approach

are summarised in Table 4.3.2.1. However, SNA incorporates a broad toolkit of metrics and designs.

Table 4.3.2.1: Advantages and disadvantages of SNA as a research tool. After Borgatti et al., 2009; Edwards, 2010; Emirbayer & Goodwin, 1994; Kane et al., 2014; Kudaravalli & Faraj, 2008.

Advantages	Disadvantages
Provide new insights by visualization of complex networks of relationships	Networks are static – shows the product, but not the process which created it
Network structure can be characterised by calculating metrics	In cases where the nodes represent people, they have agency – so may be consciously changing the network structure
Comparisons can be made with models to help explain the phenomena and generalize results	SNA approaches were developed in a pre-Internet era – so caution should be exercised when applying them in online environments

A key consideration when designing a study using SNA is defining the population and boundaries of the network (Prell, 2012). SNA can be applied at a range of levels of analysis, from individual actors to entire networks (Prell, 2012); in the context of this study, this would range from the properties of an individual academic within a network, to the entire network of connections on an academic social networking site, for example. The population which will be sampled from in theory includes any academics who use Twitter and academic SNS.

For the reasons discussed in Chapter 3, drawing upon gaps in the literature and the results of the pilot study, the level of analysis will focus upon the actor within their personal (or 'ego') network, on two sites (Twitter and Academia.edu/ ResearchGate). As DeJordy and Halgin (2008) note, a focus on the ego-network level is appropriate when RQs are concerned with "phenomena of or affecting individual entities across different settings (networks)" (DeJordy & Halgin, 2008, p.11). Sampling at the level of ego-network involves mapping an individuals first-degree contacts (in the context of the sites involved, their 'followers' and

'following') and the connections that exist between them (Prell, 2012; Wasserman & Faust, 1994, p.42). The participant whose personal network is being sampled may be referred to as 'ego' and the other members of the network as 'alters'. An example of an ego-network derived from the author's Facebook profile is shown in Figure 4.3.2.1.

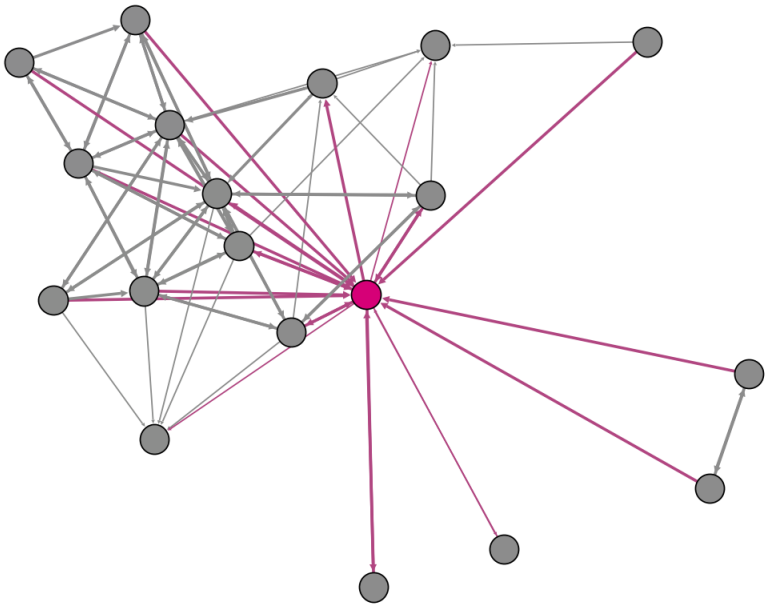


Figure 4.3.2.1: Example of a personal or ego-network.
'Ego' here is shown in pink and the grey nodes 'alters'.

The survey attracted a sufficiently large response (528 participants) to be able to adopt a purposive sampling approach to the pool of respondents in order to select a sample of participants for network analysis. Purposive sampling selects potential participants according to criteria related to the RQs (Arber, 2001; Maxwell, 1998; Teddlie & Yu, 2007). Sampling was informed by the concept of identity-trajectory to include a range of disciplines and job positions, as research suggests that the nature of being an academic is subject to differing strands at differing stages of a career trajectory (McAlpine & Akerlind, 2010).

The following criteria were applied:

- Indicated a willingness in the survey to take part in network and interview activities.
- Based in the UK (for practical purposes in arranging interviews).
- Humanities, Natural Sciences and Social Sciences were selected as contrasting disciplines (Formal Sciences were excluded due to a low response rate; Professions were excluded due to encompassing a wide variety of traditions).
- A variety of job positions were recorded in the survey. Professors, Lecturers, Researchers and Graduate Students were selected as (i) the best represented groups, (ii) contrasting perspectives spanning academic career trajectories.

By applying the sampling criteria, the number of potential participants per job position and discipline combination is shown in Table 4.3.2.2.

Table 4.3.2.2: Number of potential participants for network analysis derived from survey responses, cross tabulated by job position and discipline.

		Job position			
		Professor	**Lecturer**	**Researcher**	**Graduate student**
Discipline	Humanities	1	12	8	9
	Natural Sciences	4	7	4	7
	Social Sciences	4	18	10	9

The number of potential participants for network analysis per category in Table 4.3.2.2 raised the question of how many participants per category should be sampled in order to be able to draw statistical comparisons based on SNA metrics

across the two factors of job position and discipline. Based on the number of responses, the number of potential participants to sample per category had a potential range of between four and seven, if the professorial category was discarded.

This is a question of statistical power; statistical power is (1-β), where β is the probability of a type II error. Type II error is a false negative, or not rejecting the null hypothesis when it is indeed false (see Table 4.3.2.3) (Field, 2009).

Table 4.3.2.3: Explanation of error types in hypothesis testing.

		Actual situation in population	
		Null False	**Null True**
Result of statistical tests	Reject Null Hypothesis	Correct decision	Type I error
	Fail to reject Null hypothesis	Type II error	Correct decision

As statistical power increases, the chances of making a type II error decrease. Power is increased by adding replicates (i.e. increasing the number of participants from each category) although the benefit added by each additional replicate diminishes as the number of replicates is increased (Figure 4.3.2.2).

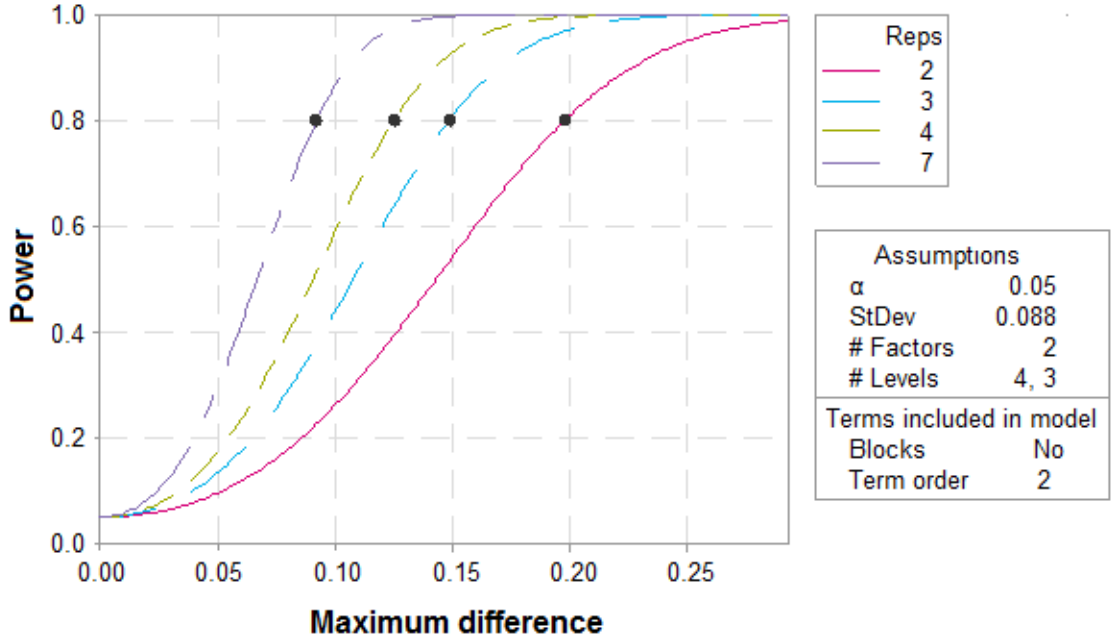


Figure 4.3.2.2: Power curves for a general full factorial design based on two factors of three and four levels up to a maximum of seven replicates.

Power analysis can predict the power of a given statistical test based on number of replicates and a predicted standard deviation. This was carried out using the full factorial design tool in Minitab, in order to assess the effects of sampling between four and seven replicates, using an exemplar standard deviation derived from the pilot study data (based on the centrality metric); 0.8 is highlighted in Figure 4.3.2.2 as it is a reasonable value to aim for (Field, 2009). For each curve, the power also increases as the size of the putative effect increases (larger effects are easier to detect).

The power curves show that a design based on four replicates would be able to detect significant differences greater than 0.12. Increasing the number of replicates to seven would reduce the difference to 0.09. Given that the added benefit of increasing replicates between four and seven would provide diminishing returns in relation to the increased data collection, and 0.12 is a reasonable

amount of difference to be able to confidently detect (several of the SNA measures have values between zero and one), four replicates represent a reasonable sample size. This would yield an ideal total sample for network analysis of 48.

In practice, the sample was expanded to include 55 academics. An initial sample of 45 was constructed (less than the goal of 48, due to an under-representation of Arts and Humanities Professors), and data collected. However, the sample included several participants from subject areas which did not sit clearly within the disciplinary categories based on the HESA classifications (Appendix D). Examples included a number of Neuroscientists who had been sampled as Social Sciences (through being grouped with Psychologists), and a number of Classicists who had been sampled as Social Scientists (through grouping with Archaeology). As a result, the sampled Neuroscientists were reclassified as Natural Scientists, Classicists as Humanists, and additional participants were sampled to ameliorate the effects of the redistribution.

The number of participants in the final sample of 55, according to job position and discipline, is shown in Table 4.3.2.4.

Table 4.3.2.4: Number of actual participants for network analysis derived from survey responses, cross tabulated by job position and discipline.

		Job position			
		Professor	**Lecturer**	**Researcher**	**Graduate student**
Discipline	Humanities	3	5	5	5
	Natural Sciences	4	5	3	4
	Social Sciences	4	5	6	6

Per participant, their ego-networks were sampled from two platforms: Twitter, and one specifically academic SNS (either Academia.edu or ResearchGate). The

decision to sample from these platforms was based on initial results from the online survey and Nature survey. Twitter was selected as a recent large-scale survey of academics indicated that it is a relatively well-known generic site, used for a range of academic purposes (NPG 2014; Van Noorden, 2014; see Figure 1.2.1); the choice of either Academia.edu or ResearchGate was based on being the most well-known academic SNS, and disciplinary differences in the extent of uptake on one site or the other (Jordan, 2014b; Van Noorden, 2014). In instances where participants use both Academia.edu and ResearchGate, the platform which they use more extensively was selected.

Automated tools were used to collect network data, between March and July 2015. Twitter data was obtained using NodeXL (Smith, Shneiderman, Milic-Frayling, Rodrigues, Barash, Dunne, Capone, Perer & Gleave, 2009), as this includes a built-in function to gather data via the Twitter API. Unfortunately, no such tool or API exists for Academia.edu or ResearchGate; data from Academia.edu was collected using Mozenda, a commercial web scraping programme, while data from ResearchGate was collected directly by the researcher as the service terms and conditions prohibit automated means.

Once the raw data had been collected (in the form of two-column spreadsheets, each row containing information about an edge between two nodes in the format of a pair of ‘source’ and ‘target’ names), this data was imported into Gephi (Bastian, Heymann & Jacomy, 2009) in order to perform network analyses and generate visualisations. The nature of the social network data collected (i.e. ego-networks) defines the types of available analyses and metrics to an extent; some approaches designed for full networks may not be appropriate here (DeJordy & Halgin, 2008), while certain measures appropriate for whole networks can be

applied by adjusting the ego-networks to remove ego herself (Borgatti, Everett & Johnson, 2013).

Analyses suitable for ego-networks are either topological (concerned with the size and structure of the network) or compositional (focusing for example upon the characteristics of network participants) (DeJordy & Halgin, 2008). An overview of the analyses and metrics suitable for ego-networks is shown in Table 4.3.2.5.

Table 4.3.2.5: Social network analyses appropriate for use in relation to ego-networks (Borgatti, Everett & Johnson, 2013; DeJordy & Halgin, 2008; Prell, 2012).

Types of analysis	Types of question	Appropriate metrics
Size	How many people is the participant connected to?	Degree; In-degree and out-degree for directed graphs
	How many communities is the participant part of?	Modularity
Structure	Does the participant connect people who would otherwise be unconnected?	Structural holes (betweenness centrality)
		Brokerage
	To what extent are the participants' connections connected to each other?	Density
	How strong are the participants' ties with those in their ego-networks?	Reciprocity
Composition	Does ego connect to others like herself?	Homophily
	Are the alters similar?	Homogeneity

Since RQ1 is specifically focused upon eliciting the structure of academics' ego-networks, the metrics relating to the size and structure of the networks were implemented. Metrics relating to composition would also have been potentially useful in addressing RQ2, although logistical considerations prevented their use. While the academics' ego-networks were small enough, and metadata about characteristics such as job position or discipline readily available, from the academic SNS to be able categorise their constituent nodes, the Twitter networks

were larger and lacked such information. Use of composition metrics was therefore restricted to the academic SNS (Academia.edu or ResearchGate) of participants who took part in interviews. Issues of network composition were also addressed through the interview discussion (Section 4.3.3). Metrics which were implemented across the full sample of ego-networks and platforms were analysed via nonparametric statistical tests (Kruskal-Wallis and median tests) in order to address the RQ3 (Field, 2009). Nonparametric tests were used as a number of SNA metrics are not well described by Poisson or normal distributions (Barabasi, 2011).

4.3.3 Interviews

The purpose of the interviews was to gain insight from the participants' perspective about the role that their ego-networks play; the interviews were co-interpretive (literally an "inter view", as Kvale (1996, p.14) puts it), with discussion centred upon the network graphs and interpretation of their structure. The concept of using network visualisations as a conversational tool to investigate social networks with participants is not widely used but has roots in Sociology and 'participant-aided sociograms' (Hogan, Carrasco & Wellman, 2007). Molina, Maya-Jariego and McCarty (2014) highlight the utility of discussion centred upon network visualisations in mixed methods SNA designs, particularly when focused upon ego-networks due to their highly personal nature. For the participants selected to take part in interviews, the network visualisations were exported as web pages from Gephi using the Sigma.js exporter (Hale, 2012). These pages were then hosted on password-protected web space; links and login details were shared with participants ahead of interviews.

The interviews were semi-structured in format (DiCicco-Bloom & Crabtree, 2006; Wengraf, 2001); a pre-planned interview schedule (shown in Table 4.3.3.1) was used to ensure that key topics were discussed, informed by the results of the network analysis, but with enough flexibility to explore unexpected aspects if they emerged.

Table 4.3.3.1: Semi-structured interview schedule for co-interpretive interviews.

Ice breaking:
Thank participant for survey participation
Recap on research progress so far
Recap on participants' job position
For each network (academic SNS first, followed by Twitter):
When did they start using the site? Why?
What were your impressions of the network graphs? Did they raise any questions?
How would you explain the communities (clusters) within the networks?
How would you explain the nodes which do not fit into communities?
As an academic, are there particular parts of the networks which you would consider to be more important? Why?
Are there any aspects of the visualisations which strike you as surprising or unexpected?
How would you explain differences in structure between the different networks?

The themes for discussion complement the metrics used in the network analyses (Section 4.3.2), seeking to gain insight into the metrics with particular focus on understanding the structural characteristics which emerged (such as defining communities) and the narrative surrounding how the network structure came to be (Molina, Maya-Jariego & McCarty, 2014). The advantages afforded by interviews (Table 4.3.3.2) complement the disadvantages associated with survey or network data alone (see Sections 4.3.1 and 4.3.3).

Table 4.3.3.2: Advantages and disadvantages of interviews as a research tool. After Cohen, Manion & Morrison, 2007; DiCicco-Bloom & Crabtree, 2006; Kvale, 1996; Oppenheim, 1992; Yin, 1994.

Advantages	Disadvantages
Enables collection of rich data	Requires relatively large time commitment
Rapport can be established	More difficult to generalize from fewer participants
Flexible – allows alternative ways of discussion and to explore new issues as they emerge	Every interview will differ so reliability may be an issue
Participants are not constrained in their responses and can use their own words to express themselves	Response bias

Interviews were held with a sub-sample of participants, sampled from within the pool who had taken part in the network analyses. The decision not to interview the full 55 network participants was made after considering the goals of the interviews within the research design and practical constraints. Determining how many qualitative interviews is appropriate is not a question which has a definitive answer but rather depends upon a combination of issues relating to the epistemology of the study and context, practical issues concerning the particular research setting, and whether 'how many' is even an appropriate question in relation to qualitative research interviews (Baker & Edwards, 2012). Each of these issues will be briefly discussed in relation to the study, providing a rationale for the number of participants sampled to take part in interviews.

For practical reasons (see limitations of interviews as a research method, Table 4.3.3.2), considering the time involved in arranging, conducting, transcribing and analysing interviews, interviewing the full sample of 55 academics may not be feasible within the scope of the study at hand. Mindful of the requirements of the study to fulfil the award of a doctoral degree, satisfying the institutional and cultural

criteria commensurate with this status within a set time frame, some venture estimates of appropriate samples; for example, Ragin suggests 50 as an appropriate size for a PhD; Adler and Adler advise a range from 12 to 60 (Baker & Edwards, 2012); while Bryman refers to analysis of doctoral thesis abstracts which yielded a mean average sample of 31 (Bryman, 2012, pg. 426).

In considering issues related to qualitative interviews as a research method, such issues are closely related to the epistemology of the study and its goals. Qualitative research, at one extreme, may only require a single interview if the case at hand is particularly illuminative or unique (Passerini & Sandino, in Baker & Edwards, 2012). This may be of particular importance for example in settings using narrative inquiry or discourse analysis (Charmaz, 2014). In contrast, in settings where the interviews are used with a view to developing grounded theory, it is arguably not possible to know at the outset how many interviews would be required to achieve saturation (Ragin, Wolcott in Baker & Edwards, 2012). However, even taking this viewpoint, the number of interviews required may not be large in practice (Ragin, ibid.); reflecting on their practice in an earlier study, Guest, Bunce and Johnson (2006) suggest that the main themes were established after 12 interviews (although they caution that this figure would need to be greater if the sampled population were more heterogeneous). Larger sample sizes are required if research seeks to compare findings from different groups (Brannen, Becker in Baker & Edwards, 2012).

The study here does not align exclusively with either extreme. Reflecting the ontological and epistemological complexity of the RQs (Section 4.1), the qualitative interviews form part of a mixed methods design. Rather than serving as the sole empirical basis of the study, the role of the interviews is to triangulate with

the other research activities and provide an insight into the participants' own views and interpretations of their networks. Each can be viewed as an illustrative case study in its own right. In order to address the RQs, particularly RQ2, enough interviews are required to be able to draw out themes in relation to how academics construct and interpret their networks. An additional layer of complexity is added by RQ3, which necessitates comparisons in terms of job positions and disciplines and would suggest a larger sample size. Given the factors discussed previously and considering the context here, two participants per combination of job position and discipline were selected to take part in interviews; that is, half of those involved in network analysis.

On this basis, 24 academics were invited to take part in interviews, and a total of 18 interviews were held. Each took place online via Skype; screen sharing was used so that both the interviewer and participant could see the network under discussion. Both audio and screen video were recorded during each interview, using Camtasia. The technical setup of the interviews is illustrated in Figure 4.3.3.1.

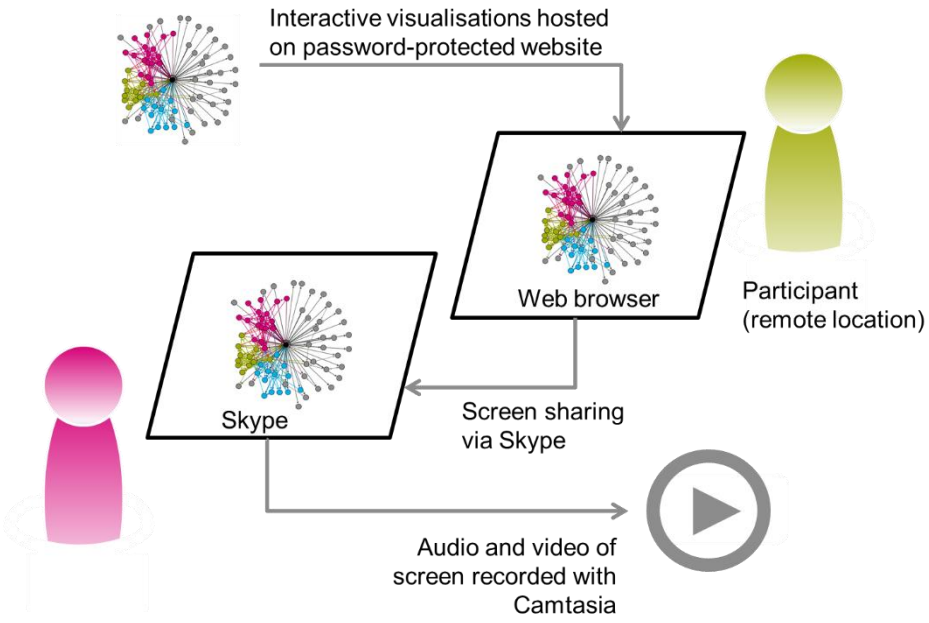


Figure 4.3.3.1: Summary of the technical setup for the interviews.

The interviews were audio recorded, and transcribed, in order to gain a greater level of familiarity with the data commensurate with a phenomenological approach (Tesch, 1990). As the interviews were co-interpretive in nature, the transcription process included two elements. First, interview data was used to annotate structure in the network graphs; and second, instances where academics voiced explanations and personal reasons for their connections and use of the sites. These data were combined with their demographic characteristics and Likert scale responses to create rich case studies of each participant and their engagement with the networks.

How academics construct and understand their networks (RQ2) was addressed primarily through the interviews. Analysis of the discussions in this respect used a grounded theory approach (Glaser & Strauss, 1967; Taber, 2009). Given the ethos and philosophical underpinnings of the project, analysis was undertaken particularly in the manner of grounded theory (Charmaz, 2014). Transcripts were

imported into nVivo and underwent three phases of coding. Initially, open coding was used. Open codes closely reflected the phrases and words used by participants, using constant comparison during the process. In practice, a sense of approaching theoretical saturation (Morse, 2007) was gained after the ninth interview. Second, open codes were combined into emergent categories. At this point, the emergent categories were applied to a fresh set of transcripts in nVivo, to check that the categories were applied consistently to the whole sample. Emergent codes in turn underwent axial coding into themes (Charmaz, 2014; Strauss & Corbin, 1998). Throughout the process, qualitative sense-making strategies suggested by Miles and Huberman (1994) were drawn upon. The process is shown graphically in Figure 4.3.3.2.

The resulting coding scheme was applied in nVivo by a second coder to half of the transcripts in order to assess inter-coder reliability. This yielded a Cohen's Kappa value of 0.59 (Cohen, 1960). According to the most frequently used categorisations of Cohen's Kappa, this value falls within 'moderate (0.41 to 0.60)' (Landis & Koch, 1977) or 'fair to good (0.40 to 0.75)' levels of agreement (Fleiss, 1981).

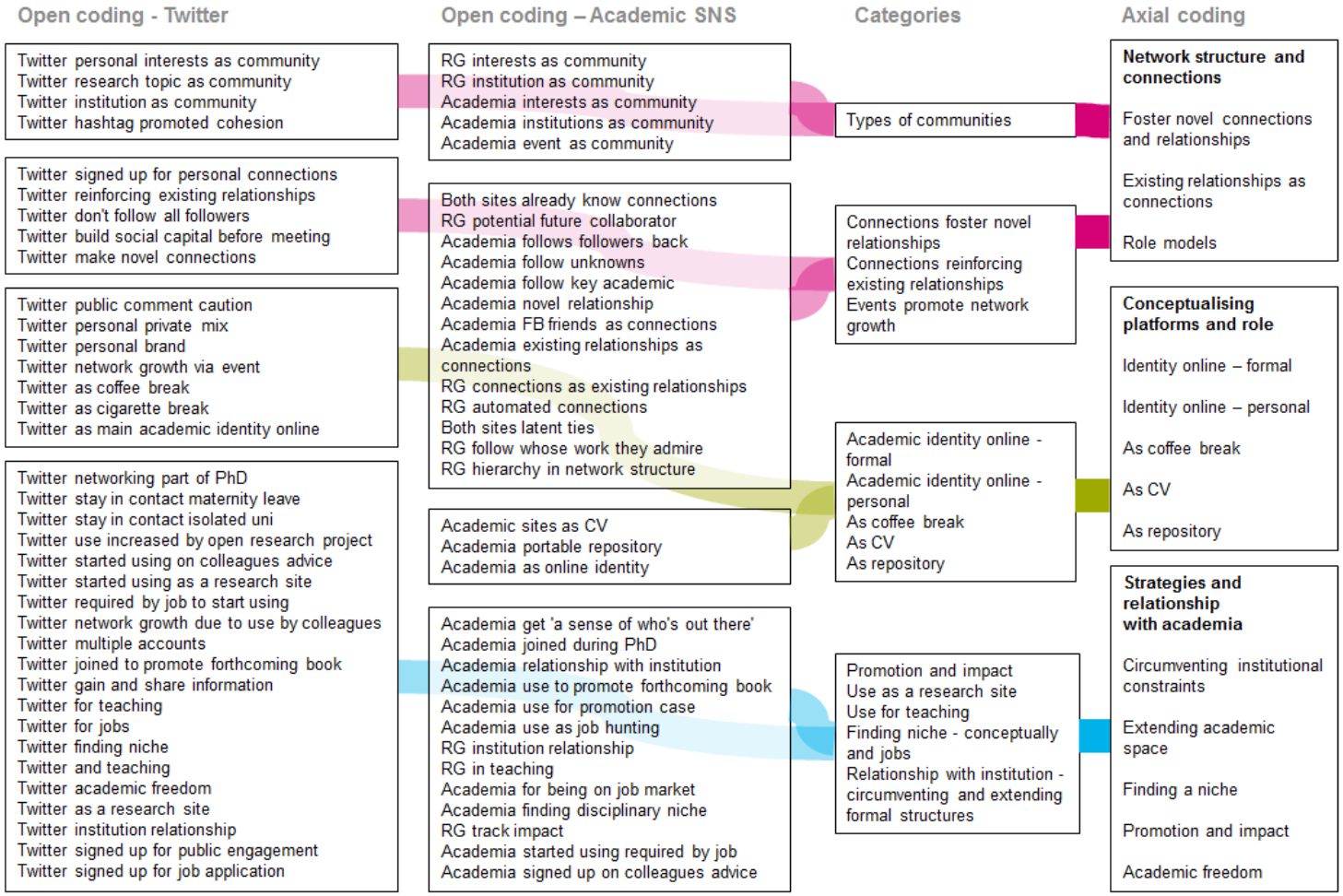


Figure 4.3.3.2: Representation of the open codes, emergent categories and themes during the process of qualitative analysis.

4.4 Validity and reliability

The concepts of validity and reliability consider the extent to which you can be confident that a research study and its results are accurate. Validity addresses whether the data collected accurately reflect the phenomena under inquiry, while reliability focuses upon the reproducibility of the data produced by the research instruments involved (Hammersley, 1987). However, inconsistency is common in the use of both terms (Hammersley, 1987; Winter, 2000), and Golafshani (2003) argues that validity and reliability are concepts born of quantitative methodologies and positivist epistemology. Given that the project here is complex and does not align neatly within a single research paradigm (Section 4.1), it is necessary to consider each concept within the context of the combination of research methods and questions here. While the constituent research methods are both quantitative (survey and network analysis) and qualitative (interviews), case studies will form the vehicle to unite the data and the RQs will ultimately be answered through cross-case analysis, so the study is underpinned by a qualitative ethos.

Issues of validity are concerned with the level of confidence in the data and its analysis; as Maxwell (1998, p.91) puts it, questions of “how might you be wrong?”. Qualitative research validity checklists serve as a mechanism to mitigate such risks (Maxwell, 1998; Miles & Huberman, 1994). To this end, several strategies were applied at critical points in the research process.

The survey formed the first phase of the study, which acted as a mechanism for recruiting participants and formed an empirical base-line of responses about academics’ perceptions about the extent and ways of using SNS for academic purposes. Statistical tests were used to examine differences according to

discipline and job position. Validity was checked in this context by a process of triangulation; that is, using different methods to verify the same phenomenon (Maxwell, 1998; Miles & Huberman, 1994). In this case, the results of the survey were verified by comparison with data from two other surveys: first, the survey undertaken as part of the pilot study (Jordan, 2014a); and second, a published dataset from a large-scale survey undertaken by Nature Publishing Group focused upon use of SNS by academics (NPG, 2014; Van Noorden, 2014).

This approach, including the incorporation of selected questions verbatim from the Nature survey, also examines reliability, through the reproducibility of survey results. A direct comparison of the identical questions in both the Nature survey and the online survey is shown in Section 5.4. Similarly, the network analyses are quantitative in nature, and the mechanism to safeguard validity and reliability will be through comparison with a larger body of academic network data collected during the pilot study (Jordan, 2014a).

In contrast, the interview data and cross-case analysis is qualitative, and in turn require different mechanisms to ensure validity and reliability. The interviews served to gain insight into participants' views on their network data; while trends were identified by the researcher, the meaning was discovered through interviews. This process built in validity checks through confirmation with participants (Gray, 2009), member checks, and gaining rich data about a sub-sample of participants (Maxwell, 1998).

The validity of the study in relation to the case studies (combining network, survey and interview data) is perhaps the most critical aspect of the research design. As the sample of case study participants is relatively small and researcher plays a

central role in the construction and interpretation of the cases (Robson, 2002), there is greater risk of a similar study reaching different conclusions. In the context of mixed methods SNA studies, Molina, Maya-Jariego and McCarty (2014) highlight the value of interviews based upon interpreting network visualisations for improving reliability. The use of co-interpretive interviews, drawing upon network visualisations and survey data in discussion with each participant, will help mitigate these risks. To assess the reliability of the emergent themes from analysis of the interview transcripts, the coding scheme was applied to half of the interviews by a second coder, and inter-coder reliability calculated (Section 4.3.3).

However, it should also be cautioned that reliability and the reproducibility of the study is linked to assumptions about how generalisable the results are. Striving for generalisability is an assumption linked to a quantitative, post-positivistic paradigm (Maxwell, 1998). In the context of an interpretivist, qualitative-based paradigm, generalisation is not necessarily sought. Rather, the *transferability* of research (Guba & Lincoln, 1989), preferring this term to generalisability for qualitative research studies which are more concerned with the detail of the research setting in question, and is applicable to the case study approach here.

4.5 Ethics

Ethical principles were established to guide the project, based on a combination of ethical and legal factors, in relation to data collection from online sources, research using human subjects, and websites' Terms of Service (ToS). As the project required a variety of different forms of data to be collected, ethical considerations needed to be borne in mind at all stages of the research.

Collecting data from online sources, particularly social media such as academic SNS, is a recent development in social research and does not have established ethical practices although a growing body of work focuses upon the ethics of internet research (Buchanan & Zimmer, 2012). There is a great deal of diversity in settings for internet based research, and while guidelines exist, these acknowledge the importance of considering the context of the particular online research project (Markham & Buchanan, 2012).

The argument is often made that online sources which are considered 'public' – that is, access is not restricted, information that can be viewed by anyone online – are freely available for researchers to use, without requiring consent from authors of those sources; "the greater the acknowledged publicity of the venue, the less obligation there may be to protect individual privacy, confidentiality, right to informed consent, etc." (Ess et al., 2002, p.5). It is important to note here that in the context of studying an online academic network, while it would be desirable to seek informed consent prior to data collection from all users in the network, the networks are large so this would be not be realistic to obtain. If profiles were only included on the basis of those from whom explicit consent had been obtained, this would not create a complete view of the network structure and skew the object of study.

However, as boyd & Crawford note when discussing 'Big Data', "just because it is accessible doesn't make it ethical" (boyd & Crawford, 2011, p.10). For example, when considering Facebook as a source of data, van Gilder Cooke (2011) notes that users probably do not consider researchers as an audience when they are creating profiles and posts likely intended to stay between friends. The distinction between public and private in online settings is messy (boyd, 2010), so

considering context is key (Eynon, Fry & Schroeder, 2008); in the case of the present study, the profiles are public, professional profiles, which by definition are being published online by the user with the explicit intention of being public and being read by others. It is also important to note that the data collected from the online profiles will be minimal, as the purpose of the study at this stage is to study network structure and whether factors of discipline or academic seniority play a role in network structure. The data collection from online platforms focussed solely upon the links between profiles (followers/following).

In studying online communities, Krotoski (2010) highlights the need to think about potential for harm, both to the individual and the community. To an extent, the platform is another entity concerned with preventing harm to the community; website ToS are a legal framework which may include stipulations to prevent harm to users, by way of protecting users from spam or commercial exploitation. However, ToS are not constructed primarily from the viewpoint of the community but rather the company behind the platform, derived from legal standards which are often unrelated to community norms and expectations (Fiesler, Lampe & Bruckman, 2016). As Fisher, McDonald, Brooks and Churchill (2010) highlight, websites' ToS can restrict data collection and introduce bias into sampling, which will be important to bear in mind when seeking analysis and comparison across sites. Data collection from Twitter is more straightforward as it is facilitated by their API, via NodeXL. Academia.edu does not explicitly prohibit data collection for academic purposes; ResearchGate has very restrictive ToS in relation to data collection, although a precedent has been set of permitting use if participants' consent has been gained (Hoffman, Lutz, & Meckel, 2014). In all cases, the gold

standard of informed consent was applied, and no ego-networks collected without the individual academics' permission.

In order to ensure confidentiality, the dataset which includes names was stored in password-protected electronic media, only accessible to the researcher. Any output of analysis undertaken using this dataset, echoing the case of interviews, will not include names but may include attributes of profiles, such as discipline or academic seniority. As the source of the data is public, it might be possible for the determined reader to identify individuals even from this small amount of information, so as for interviews, true anonymity may not be guaranteed although all efforts will be made to ensure confidentiality is upheld.

With these considerations in mind, a number of best-practice guiding principles were implemented in order to safeguard participants throughout the research process:

- Informed consent was gained from potential participants before taking part in the study (AERA, 2011; BERA, 2011; ESRC, 2010). This was checked at three stages; first, before taking part in the survey; second, prior to network data collection; and thirdly, before taking part in interviews.
- Although the network data collection posed no ethical concerns as it focused upon sources which could be considered public (Markham & Buchanan, 2012), permission was sought from participants before any network data was collected on their behalf.

- At no point in the research and reporting process have real names been disclosed, although attributes such as discipline or level of academic seniority have been included. Thus while it may not be possible to guarantee true anonymity, confidentiality has been ensured (Bell, 2005; Denscombe, 2007).
- In accordance with the Data Protection Act (1998), primary data has been stored in password-protected electronic media accessible only to the researcher.

An application to the Human Research Ethics Committee (HREC) was submitted and approved in October 2014 (reference number HREC/2014/1325/Jordan/3). The application and supporting documents are shown in Appendix D.

4.6 Summary

Mixed methods SNA was chosen as the methodological approach for the study, as the RQs are complex and do not sit easily within a single research paradigm. A robust mixed methods research design was constructed to balance tensions between quantitative questions of network structure and qualitative questions about social processes and interpretation. Triangulation between research methods, participant checks and inter-coder reliability testing were the mechanisms of ensuring validity and reliability. The limitations of the research design will be discussed in Chapter 9.

In the succeeding chapters, the results will be discussed, focusing in turn upon the survey, networks, and interview data. This will take the reader from a broad contextual level through to individual case studies. At each level, results will be

assessed in relation to the RQs. Full discussion and conclusions will integrate the data sources through cross-case analysis in Chapters 8 and 9.

5. Results: Survey data and context

This chapter presents the results of the survey and its analysis, providing insight into broader trends in use of online social networking tools by academics. It demonstrates a picture of the landscape of academic practice surrounding academic SNS, creating context to set the network analyses (Chapter 6) and case studies (Chapter 7) within.

5.1 Demographic characteristics of the dataset

The design and execution of the survey has been described in detail in Section 4.3.1. The survey ran online from November 2014 to February 2015, accruing 528 responses.

The proportion of responses according to discipline and job position are shown in Tables 5.1.1 and 5.1.2, respectively. The coding scheme which was used to create common categories for job position and discipline is shown in Appendix C.

Table 5.1.1: Percentage of survey respondents according to discipline.

Discipline	n	Percentage of respondents
Arts & Humanities	100	18.9
Formal Sciences	26	4.9
Natural Sciences	72	13.6
Professions	173	32.8
Social Sciences	148	28.0
Other	9	1.7
Total	**528**	**100.0**

Table 5.1.2: Percentage of survey respondents according to job position.

Position	n	Percentage of respondents
Graduate student	137	25.9
Researcher	92	17.4
Lecturer	164	31.1
Professor	97	18.4
Other	38	7.2
Total	**528**	**100.0**

The introductory section of the survey also asked respondents about their levels of use of a variety of different SNS. The responses to this section are summarised in Table 5.1.3.

Table 5.1.3: Summary of survey responses about level of use and awareness of a range of SNS.
The question text asked "How often do you use the following sites?".
Figures in brackets show the total percentage of respondents who have ever used each site.

Site	Most days	Most weeks	Monthly	Rarely (less than once a month)	I created a profile at the site but have not used it since	N/A
Academia.edu (74.4)	4.2	17.4	15.0	20.8	15.0	25.6
A blog (75.6)	11.7	19.9	17.2	17.2	7.4	24.4
Diigo (16.9)	0.9	1.3	1.3	4.5	3.2	83.1
Facebook (88.4)	69.1	8.1	3.6	5.1	1.5	11.6
Google+ (77.5)	6.6	10.4	14.0	22.0	21.0	22.5
Google Scholar (85.2)	19.3	34.3	14.4	12.5	2.5	14.8
LinkedIn (80.7)	10.0	26.7	19.7	15.0	8.5	19.3
Mendeley (40.2)	5.9	5.3	4.0	8.3	13.6	59.8
ResearchGate (50.8)	3.0	11.6	12.1	12.9	8.9	49.2
Slideshare (39.2)	0.8	5.1	7.6	13.8	8.3	60.8
Twitter (98.5)	86.7	8.7	0.6	1.5	0.4	1.5
Zotero (33.1)	3.8	3.6	4.7	6.3	11.9	66.9

Academia.edu, Google Scholar and ResearchGate emerged as the most widely used specifically academic tools, although their levels of use are dwarfed by the best known generic tools.

How the demographics of the sample, and responses to the identical questions, compare to the larger Nature survey dataset (Van Noorden, 2014), is discussed in Section 5.3. Consistent with their membership statistics, Academia.edu and ResearchGate emerged as the most popular academic SNS, although a disciplinary divide was apparent. Arts and Humanities and Social Sciences favour Academia.edu, and Natural Sciences preferring ResearchGate (Figure 5.1.1).

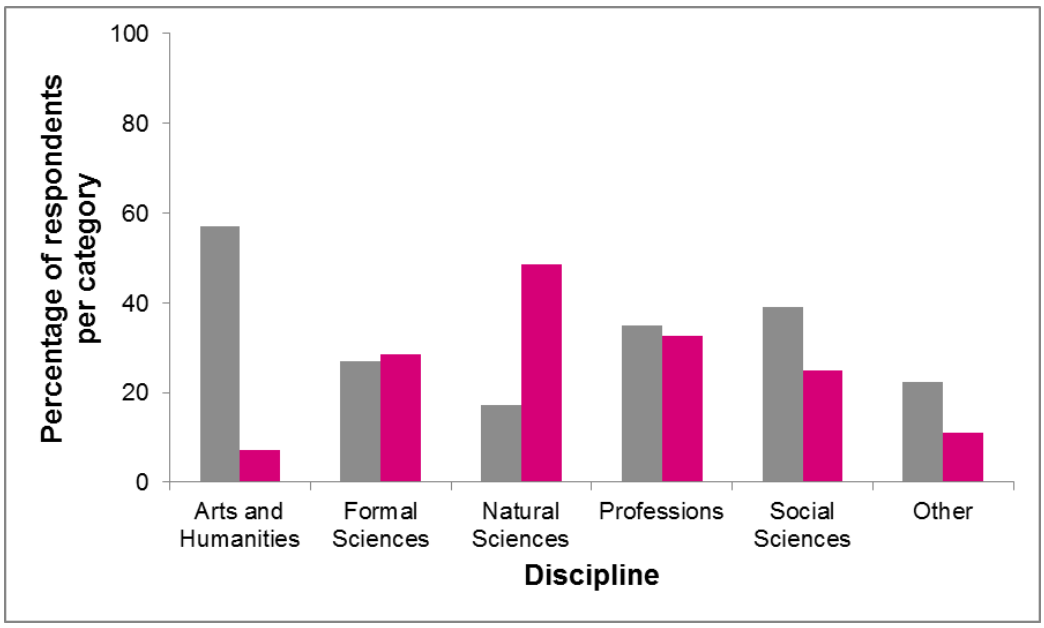


Figure 5.1.1: Percentage of respondents per discipline who used the academic SNS Academia.edu (grey bars) and ResearchGate (pink bars). This includes all who selected 'most days', 'most weeks', or 'monthly'.

5.2 Perceptions about professional use of social networking sites

Perceptions about the use of SNS for professional purposes as academics were addressed through eliciting agreement levels with a number of Likert scale items. A total of 30 Likert scale items were included in the inventory; this comprised nine

items from the Nature survey, and a further 21 drawn from a number of themes derived from the literature were included in the online survey (Section 4.3.1).

To accommodate items from the Nature survey, 24 of the items followed a five point scale from ‘strongly disagree’ to ‘strongly agree’ (responses to these items are summarised in Table 5.2.1), and six items used a four point scale from ‘not at all useful’ to ‘very useful’ (summarised in Table 5.2.2).

Table 5.2.1: Frequency of responses to the main inventory of Likert scale items. Shown in descending order of overall agreement.

Item	n	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	*% agree or strongly agree*
Social networking sites are a good way of finding out about new publications of interest	524	1	21	44	238	220	*87.4*
I use social networking sites to discover peers working in my field of research	526	5	29	33	212	247	*87.3*
Developing my online identity is important to me as an academic	524	8	19	50	229	218	*85.3*
Social networking sites allow me to draw upon a wider community of expertise when I need help	527	5	26	67	201	228	*81.4*
I actively interact with other academics via social networking sites	527	4	19	75	214	215	*81.4*
Social networking sites are a good way of promoting my own academic publications	526	5	21	86	238	176	*78.7*

Item	n	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	*% agree or strongly agree*
Being able to ask questions of the online community is important	526	5	27	84	211	199	*77.9*
I see my profile as an online business card	526	13	40	70	207	196	*76.6*
I use social networking sites to discover individuals outside my field of research	524	13	43	89	224	155	*72.3*
Social networking sites are a useful way to support working in collaboration with other researchers	527	4	35	108	228	152	*72.1*
I follow people as a way of staying in touch with people I used to work with	527	13	64	86	233	131	*69.1*
Social networking sites are useful to discover job opportunities	526	6	41	121	260	98	*68.1*
I follow people who I would like to work with in the future	524	4	44	122	239	115	*67.6*
I present my identity in different ways on different sites	527	33	97	72	199	126	*61.7*
I feel I should probably do more to promote my research using online networks	526	9	70	135	224	88	*59.3*
Having a profile will enhance my future career prospects	525	6	45	167	233	74	*58.5*
Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	526	12	68	149	201	96	*56.5*

Item	n	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	*% agree or strongly agree*
I use social networking sites to support my teaching activities	526	33	68	143	162	120	*53.6*
My online academic and personal identities are separated	526	53	130	96	143	104	*47.0*
I use social networking sites to track metrics relating to interest in my work	522	55	119	125	165	58	*42.7*
If someone follows me I follow them back	521	22	141	193	139	26	*31.7*
I use my profile as a research journal	521	100	192	159	60	10	*13.4*
I only follow people who I know personally	526	208	238	44	33	3	*6.8*
I don't think having a professional profile on an online network is very important	524	224	209	60	28	3	*5.9*

Table 5.2.2: Frequency of responses to the main inventory of Likert scale items. Shown in descending order of overall agreement.

Item	n	Not at all useful	Not very useful	Quite useful	Very useful	I don't know	*% quite or very useful*
Sharing authored content	528	28	37	199	213	44	*78.0*
Raising the profile of your work in the research community	528	13	56	224	181	49	*76.7*
Raising your personal profile in the research community	528	11	51	228	176	55	*76.5*
Attracting collaborators	528	31	89	198	109	94	*58.1*
Attracting future employers	528	68	112	132	44	164	*33.3*
Attracting funding	528	147	140	40	15	173	*10.4*

Further discussion of the results is arranged in this section according to the themes. All items were subject to nonparametric statistical tests to examine whether significant differences were present according to the factors of job position and discipline; only those which yielded significant results are reported in detail. For the purposes of the tests, respondents categorised as 'other' for job position or discipline were excluded.

5.2.1 The role of social networking sites

This theme included statements about the potential role being played by SNS for academics. The main inventory of Likert scale items included:

- *'Developing my online identity is important to me as an academic' (3 of 24).*
- *'I see my profile as an online business card' (8 of 24).*

- *'I present my identity in different ways on different sites' (14 of 24)'*
- *'I use social networking sites to support my teaching activities' (18 of 24)'*
- *'My online academic and personal identities are separated' (19 of 24).*
- *'I use my profile as a research journal' (22 of 24).*

The figures in brackets denote the positions of the items in Table 5.2.1, when ranked in descending order of the percentage of respondents who either 'agree' or 'strongly agree' with each statement.

Academics were more likely to view the professional role of profiles as a static source of information rather than a dynamic way of reporting work in progress. The item '*I see my profile as an online business card*' shows high levels of agreement, while '*I use my profile as a research journal*' demonstrates a negative skew.

Three items in the survey focused upon online identity development: '*Developing my online identity is important to me as an academic*', '*my online academic and personal identities are separated*', and '*I present my identity in different ways on different sites*'. All showed a modal category of 'agree'. The item '*my online academic and personal identities are separated*' is an interesting exception to the overall skew towards agreement as it polarised opinions and showed a near bi-modal distribution, with a slightly lower proportion of responses disagreeing with the statement (Figure 5.2.1.1).

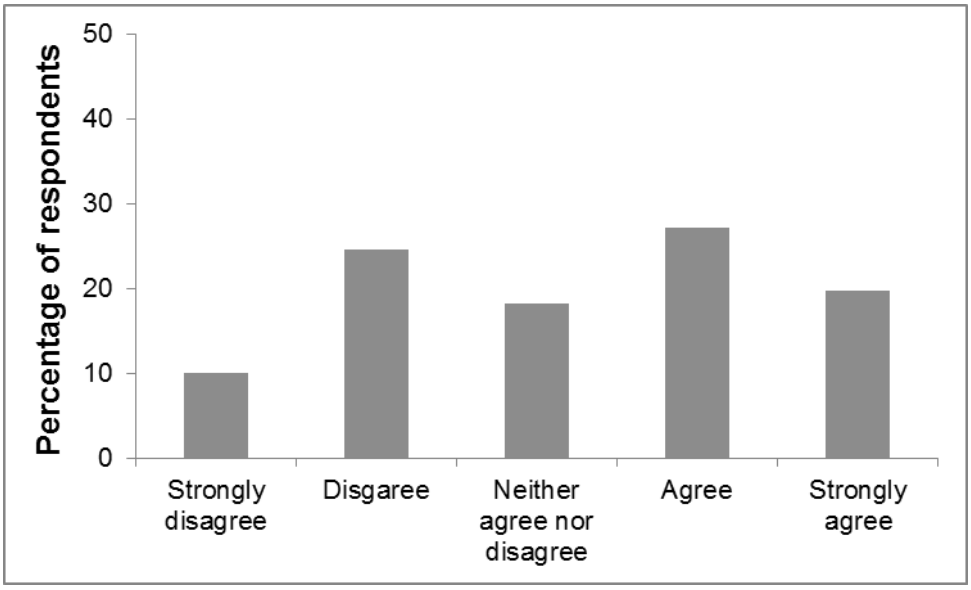


Figure 5.2.1.1: Distribution of responses to the item 'my online academic and personal identities are separated', as percentages of respondents per category (N = 526).

The item '*I use social networking sites to support my teaching activities*' showed a weak skew toward agreement overall, although this item also showed significant differences in responses according to both job position (independent samples Kruskal-Wallis test, $\chi2(3, N = 488) = 54.134, p < 0.000$) and discipline (independent samples Kruskal-Wallis test, $\chi2(4, N = 517) = 18.475, p = 0.001$). The distribution of responses according to job position is shown in Figure 5.2.1.2.

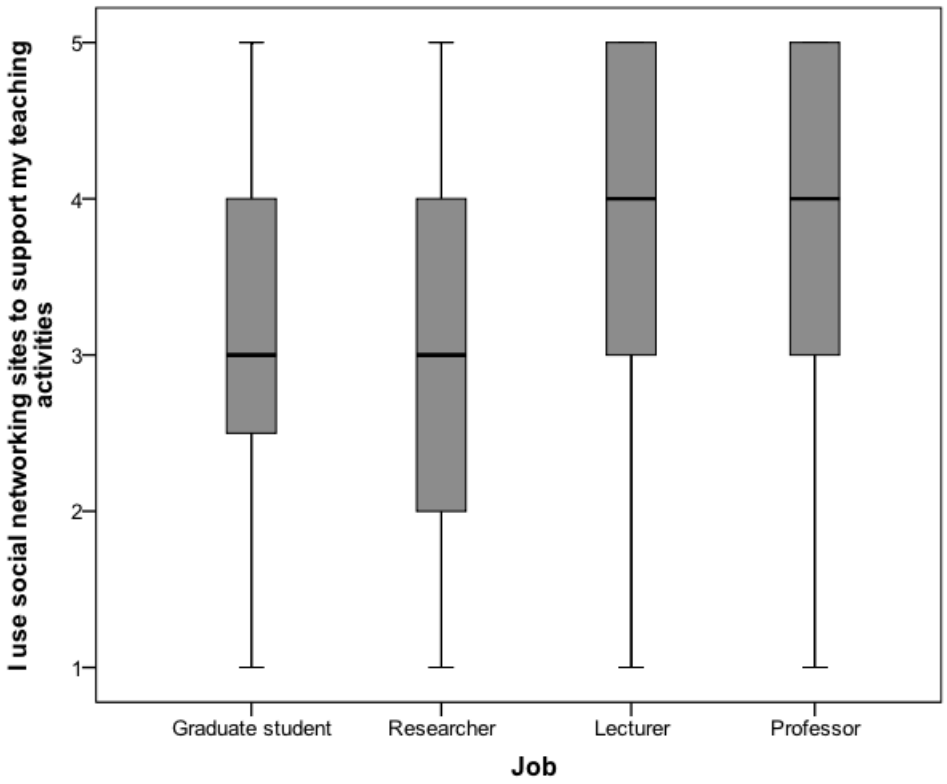


Figure 5.2.1.2: Distribution of responses in the online survey to the item 'I use social networking sites to support my teaching activities' according to job position.
1 = 'strongly disagree'; 5 = 'strongly agree'.

The results of post hoc tests examining differences according to job position are shown in Table 5.2.1.1.

Table 5.2.1.1: Results of pairwise Mann-Whitney U tests on the item 'I use social networking sites to support my teaching activities' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 6907.50 *z* = -0.745 *p* = 0.457	***U* = 6927.50** ***z* = -5.773** ***p* < 0.001**	***U* = 4794.00** ***z* = -3.666** ***p* < 0.001**
Researcher		***U* = 4172.50** ***z* = -6.087** ***p* < 0.001**	***U* = 2960.00** ***z* = -4.130** ***p* < 0.001**
Lecturer			*U* = 7094.50 *z* = -1.450 *p* = 0.147

The post hoc tests confirm statistically the divide in agreement shown in Figure 5.2.1.2; lecturers and professors showing higher agreement with the statement than graduate students or researchers.

Distribution of responses to the same item according discipline are shown in Figure 5.2.1.3 and the results of post hoc tests examining differences according to discipline are shown in Table 5.2.1.2.

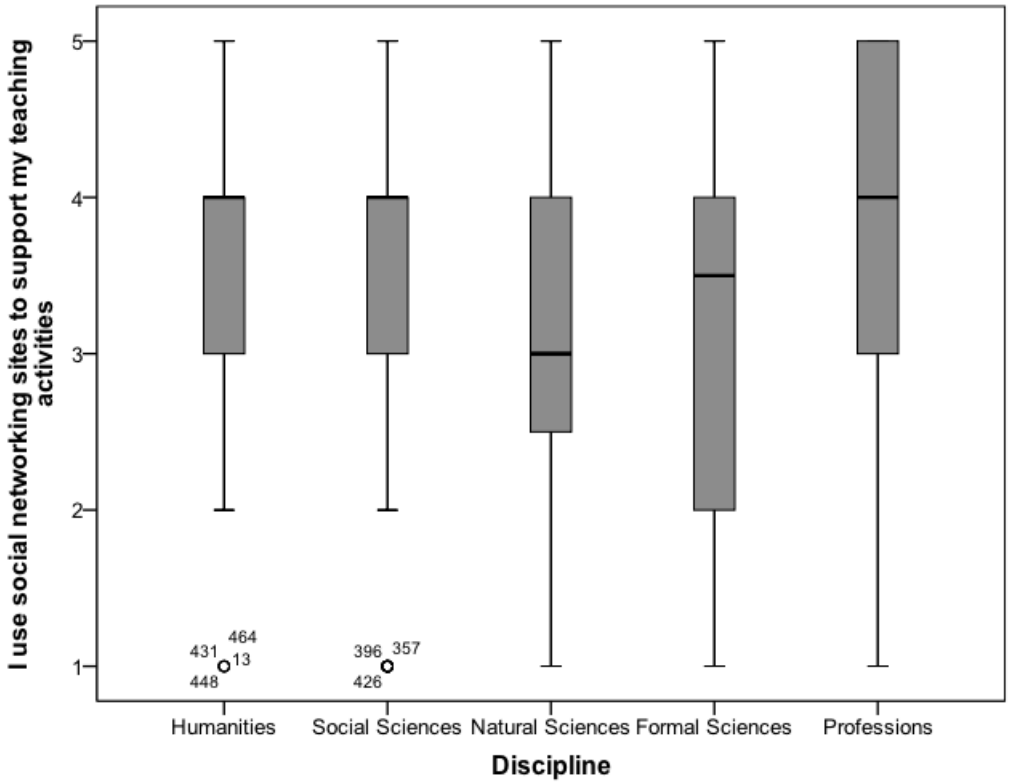


Figure 5.2.1.3: Distribution of responses in the online survey to the item 'I use social networking sites to supporting my teaching activities' according to discipline.
1 = 'strongly disagree'; 5 = 'strongly agree'.

Table 5.2.1.2: Results of pairwise Mann-Whitney U tests on the item 'I use social networking sites to supporting my teaching activities' according to discipline.
Combinations which yielded significant differences are shown in bold (adjusted α = .005).

Discipline	Social Sciences	Natural Sciences	Formal Sciences	Professions
Humanities	*U* = 7112.00 *z* = -0.538 *p* = 0.591	***U* = 2549.50** ***z* = -3.383** ***p* = 0.001**	*U* = 1154.50 *z* = -0.910 *p* = 0.363	*U* = 8140.00 *z* = -0.683 *p* = 0.494
Social Sciences		***U* = 4066.50** ***z* = -2.937** ***p* = 0.003**	*U* = 1797.00 *z* = -0.553 *p* = 0.580	*U* = 11588.50 *z* = -1.342 *p* = 0.180
Natural Sciences			*U* = 780.50 *z* = -1.302 *p* = 0.193	***U* = 4135.00** ***z* = -4.181** ***p* < 0.001**
Formal Sciences				*U* = 1878.00 *z* = -1.320 *p* = 0.187

The post hoc tests show that Natural Sciences agree with the statement to a lesser extent than other disciplines (with the exception of Formal Sciences).

The item '*I feel I should probably do more to promote my research using online networks*' showed significant differences according to discipline (independent samples Kruskal-Wallis test, $\chi 2(4, N = 517) = 11.393, p = 0.022$).

Boxplots of responses according to discipline are shown in Figure 5.2.1.4.

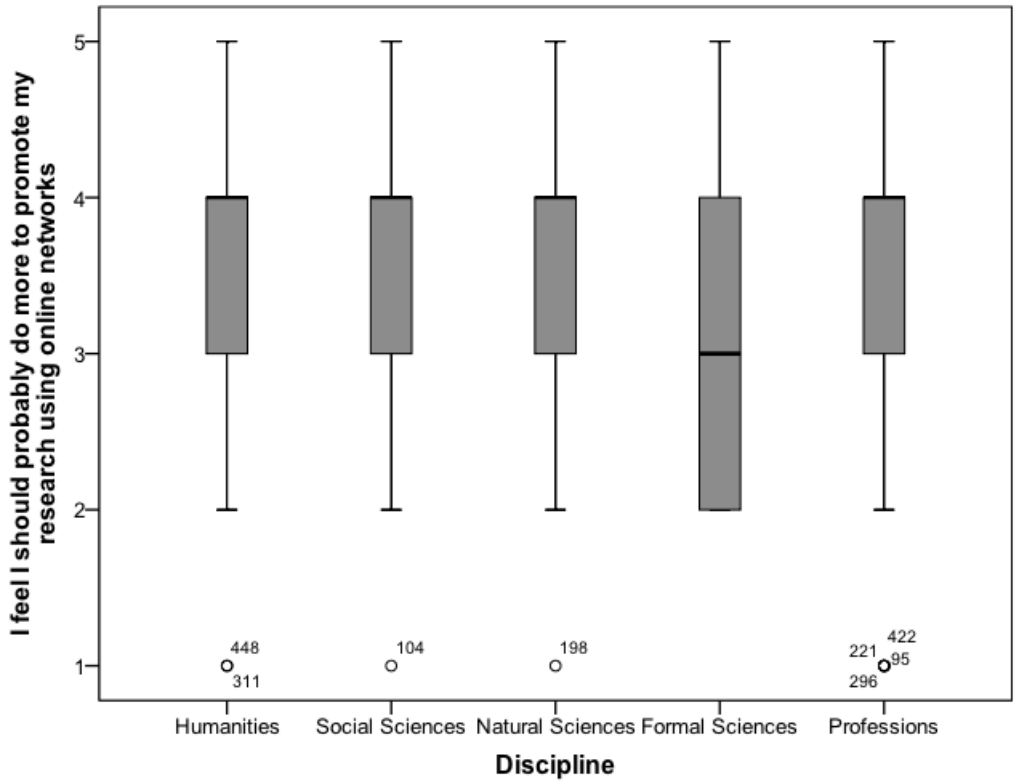


Figure 5.2.1.4: Distribution of responses in the online survey to the item 'I feel I should probably do more to promote my research using online networks' according to discipline. 1 = 'strongly disagree'; 5 = 'strongly agree'.

Different disciplines have a consistent median of 'agree' with the exception of Formal Sciences. The results of post hoc tests examining differences according to discipline are shown in Table 5.2.1.3.

Table 5.2.1.3: Results of pairwise Mann-Whitney U tests on the item 'I feel I should probably do more to promote my research using online networks' according to discipline. Combinations which yielded significant differences are shown in bold (adjusted α = .005).

Discipline	Social Sciences	Natural Sciences	Formal Sciences	Professions
Humanities	*U* = 6625.50 *z* = -1.347 *p* = 0.178	*U* = 3402.00 *z* = -0.536 *p* = 0.592	*U* = 932.50 *z* = -2.261 *p* = 0.024	*U* = 7873.00 *z* = -1.085 *p* = 0.278
Social Sciences		*U* = 5053.50 *z* = -0.661 *p* = 0.509	***U* = 1200.50** ***z* = -3.229** ***p* = 0.001**	*U* = 12511.00 *z* = -0.278 *p* = 0.781
Natural Sciences			*U* = 629.50 *z* = -2.609 *p* = 0.009	*U* = 5987.50 *z* = -0.430 *p* = 0.667
Formal Sciences				***U* = 1465.50** ***z* = -2.967** ***p* = 0.003**

Post hoc tests confirm that Formal Sciences agree with the statement to a lesser extent than Social Sciences or Professions. Formal Sciences is the smallest sub-sample (26 respondents; see Table 5.1.1) so this result may be more sensitive to outliers.

5.2.2 Network formation

Four questions were included which explicitly asked participants about network formation, in terms of attitudes towards following others. Again, the figures in brackets show the ranking positions of each statement in Table 5.2.1:

- *'I follow people as a way of staying in touch with people I used to work with' (11 of 24).*
- *'I follow people who I would like to work with in the future' (13 of 24).*
- *'If someone follows me I follow them back' (21 of 24).*
- *'I only follow people who I know personally' (23 of 24).*

Two of the items demonstrate positive skews, with modal responses in the 'agree' category: '*I follow people who I would like to work with in the future*', and '*I follow people as a way of staying in touch with people I used to work with*'. These items relate to career trajectory; forming connections based on existing face-to-face networks and imagining future working relationships. Items on the theme of careers will also be discussed in Section 5.2.6. The two other items on the theme of network formation, which were not concerned with working with people, demonstrated lower levels of agreement. '*If someone follows me, I follow them back*' showed a modal category of 'neither agree nor disagree', and '*I only follow people who I know personally*' has a modal category of 'disagree'. The perceived greater likelihood of following people with whom academics already have a working relationship, or would like one in the future, is an interesting finding and will be addressed in further detail in relation to network structure in Chapters 7 and 8.

The item '*I follow people who I would like to work with in the future*' showed statistically significant differences according to job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 486) = 25.198, p < 0.000$). The distribution of responses to this item according to job position are shown as boxplots in Figure 5.2.2.1, which demonstrates a clear trend; the level of agreement decreases with increasingly seniority. The progression is confirmed statistically in the post hoc tests, which are summarised in Table 5.2.2.1.

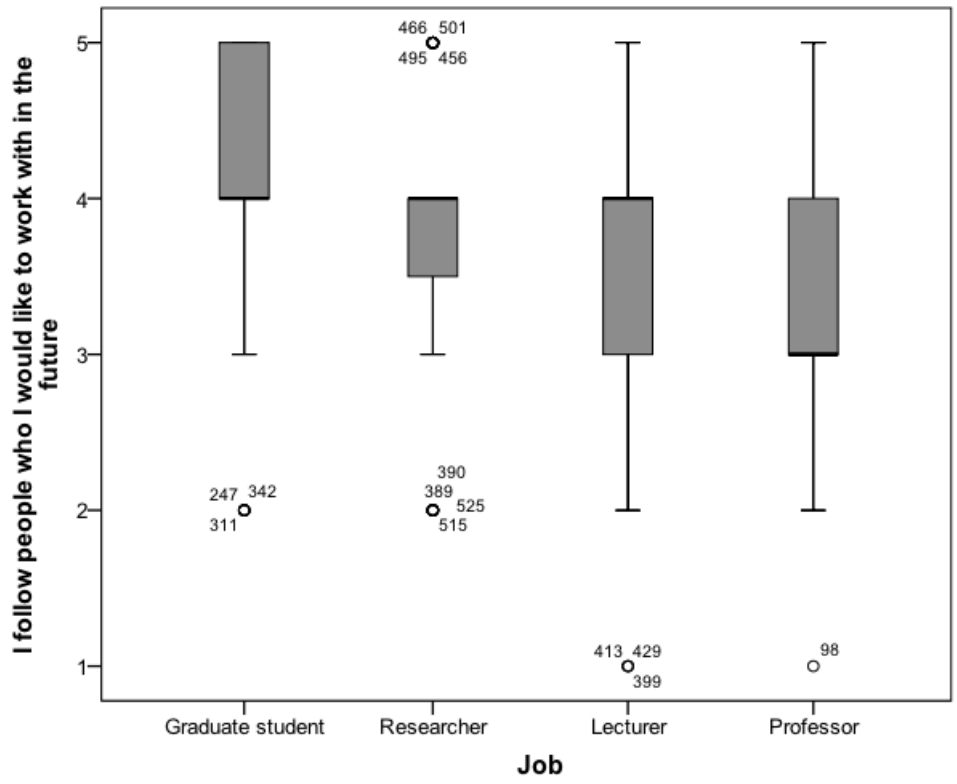


Figure 5.2.2.1: Distribution of responses in the online survey to the item 'I follow people who I would like to work with in the future' according to job position.
1 = 'strongly disagree'; 5 = 'strongly agree'.

Table 5.2.2.1: Results of pairwise Mann-Whitney U tests on the item 'I follow people who I would like to work with in the future' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 5527.50 *z* = -1.624 *p* = 0.104	***U* = 8904.00** ***z* = -3.045** ***p* = 0.002**	***U* = 4261.00** ***z* = -4.770** ***p* < 0.001**
Researcher		*U* = 6829.50 *z* = -1.187 *p* = 0.235	***U* = 3322.50** ***z* = -3.120** ***p* = 0.002**
Lecturer			*U* = 6524.50 *z* = -2.280 *p* = 0.023

5.2.3 Collaboration

Four survey items addressed collaborative aspects of SNS use:

- *'I use social networking sites to discover peers working in my field of research' (2 of 24).*
- *'I actively interact with other academics via social networking sites' (5 of 24).*
- *'I use social networking sites to discover individuals outside my field of research' (9 of 24).*
- *'Social networking sites are a useful way to support working in collaboration with other researchers' (10 of 24).*

A further item, '*attracting collaborators*', was included using the scale from the Nature survey; 58.1% of respondents selected 'quite useful' or 'very useful (Table 5.2.2). The items in the online survey all show skews towards agreement, and this category shows some of the highest agreement levels overall (Table 5.2.1). Two of the items have a modal category of 'strongly agree' ('*I use social networking sites to discover peers working in my field of research*' and '*I actively interact with other academics via social networking sites*'); the other two have a modal category of 'agree' ('*I use social networking sites to discover individuals outside my field of research*' and '*social networking sites are a useful way to support working in collaboration with other researchers*').

Two of the items showed significant differences in responses according to discipline: '*I use social networking sites to discover peers working in my field of research*' (independent samples Kruskal-Wallis test, $\chi 2(4, N = 517) = 11.949, p =$

0.018) and '*social networking sites are a useful way to support working in collaboration with other researchers*' (independent samples Kruskal-Wallis test, $\chi 2(4, N = 518) = 14.323, p = 0.006)$.

Boxplots showing the distribution of responses to the item '*I use social networking sites to discover peers working in my field of research*' are presented according to discipline in Figure 5.2.3.1.

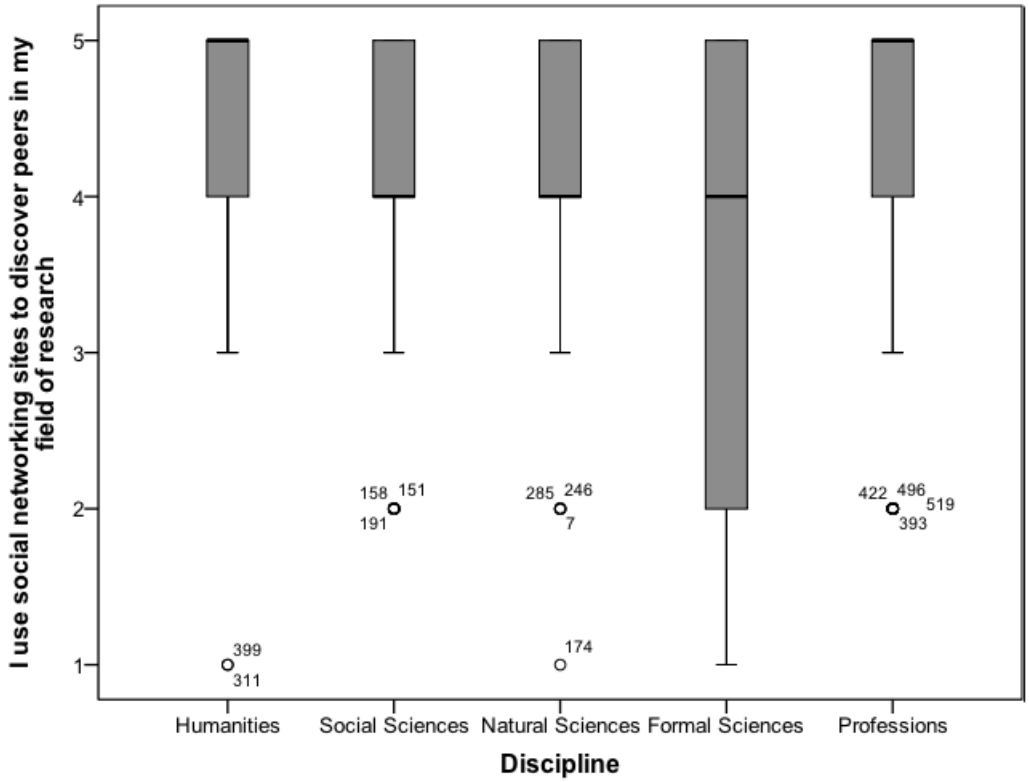


Figure 5.2.3.1: Distribution of responses in the online survey to the item 'I use social networking sites to discover peers working in my field of research' according to discipline. 1 = 'strongly disagree'; 5 = 'strongly agree'.

Post hoc tests showed that the significant differences are attributed to Formal Sciences agreeing with the statement to a lesser extent than Humanities, Social Sciences, and Professions (Table 5.2.3.1).

Table 5.2.3.1: Results of pairwise Mann-Whitney U tests on the item 'I use social networking sites to discover peers working in my field of research' according to discipline. Combinations which yielded significant differences are shown in bold (adjusted α = .005).

Discipline	Social Sciences	Natural Sciences	Formal Sciences	Professions
Humanities	*U* = 6909.00 *z* = -0.840 *p* = 0.401	*U* = 3060.00 *z* = -1.760 p = 0.078	***U* = 813.00** ***z* = -3.167** ***p* = 0.002**	*U* = 8164.00 *z* = -0.624 *p* = 0.533
Social Sciences		*U* = 4904.50 *z* = -1.050 *p* = 0.293	***U* = 1314.50** ***z* = -2.792** ***p* = 0.005**	*U* = 12565.00 *z* = -0.217 *p* = 0.828
Natural Sciences			*U* = 697.50 *z* = -2.094 *p* = 0.036	*U* = 5620.50 *z* = -1.245 *p* = 0.213
Formal Sciences				***U* = 1516.50** ***z* = -2.870** ***p* = 0.004**

Figure 5.2.3.2 shows boxplots of the distribution of responses to '*social networking sites are a useful way to support working in collaboration with other researchers*' according to discipline.

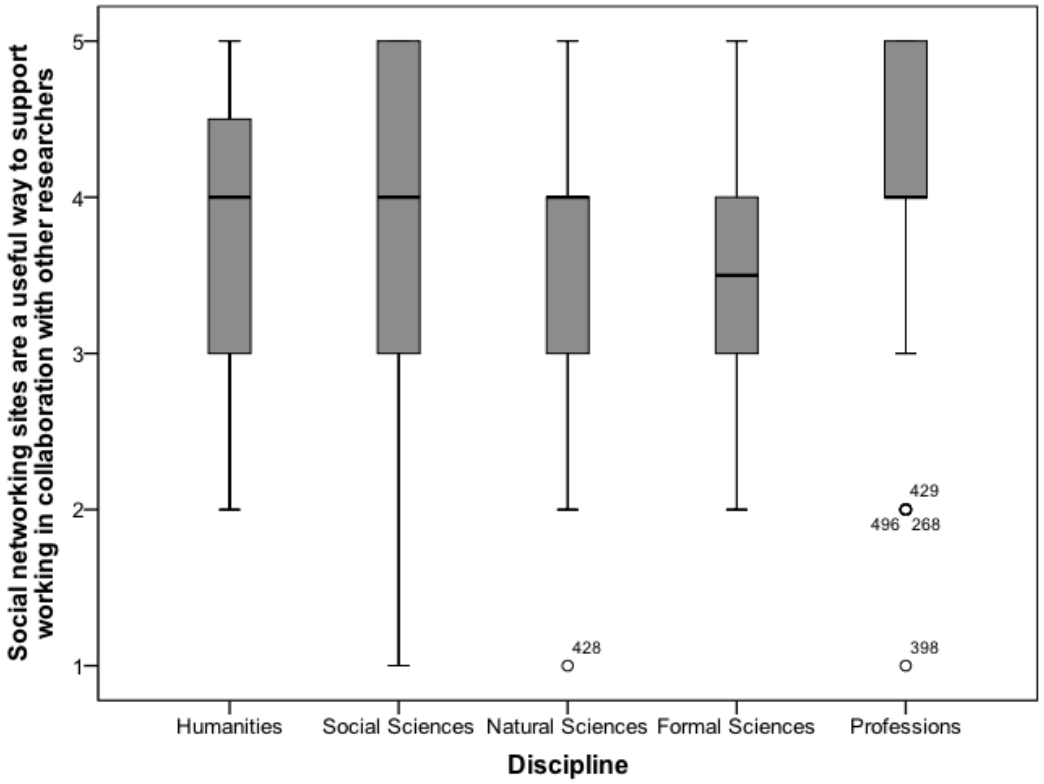


Figure 5.2.3.2: Distribution of responses in the online survey to the item 'social networking sites are a useful way to support working in collaboration with other researchers' according to discipline.
1 = 'strongly disagree'; 5 = 'strongly agree'.

The post hoc tests (summarised in Table 5.2.3.2) show that the significant difference can be attributed to Professions agreeing with the statement to a greater extent than Formal Sciences.

Table 5.2.3.2: Results of post hoc tests on the item 'social networking sites are a useful way to support working in collaboration with other researchers' according to discipline. Combinations which yielded significant differences are shown in bold (adjusted α = .005).

Discipline	Social Sciences	Natural Sciences	Formal Sciences	Professions
Humanities	*U* = 7375.00 *z* = -0.048 *p* = 0.962	*U* = 3393.00 *z* = -0.688 *p* = 0.491	*U* = 893.00 *z* = -2.619 *p* = 0.009	*U* = 7672.00 *z* = -1.595 *p* = 0.111
Social Sciences		*U* = 5027.50 *z* = -0.715 *p* = 0.475	*U* = 1368.00 *z* = -2.461 *p* = 0.014	*U* = 11532.50 *z* = -1.541 *p* = 0.123
Natural Sciences			*U* = 703.00 *z* = -1.980 *p* = 0.048	*U* = 5206.00 *z* = -2.100 *p* = 0.036
Formal Sciences				***U* = 1347.00** ***z* = -3.487** ***p* < 0.001**

5.2.4 Dissemination

Dissemination activities were addressed via two questions in the main inventory of Likert scale items in the online survey ('*I use social networking sites to track metrics relating to interest in my work*', and '*social networking sites are a good way of promoting my own academic publications*'), and a further item which was included in both the Nature and the online surveys ('*sharing authored content*').

'*Social networking sites are a good way of promoting my own academic publications*' showed a high level of agreement; ranked 6th in Table 5.2.1, 78.7% of respondents selected 'agree' or 'strongly agree'. Although '*I use social networking sites to track metrics relating to interest in my work*' demonstrated a modal category of 'agree', a wider range of responses were recorded (Table 5.2.1) and the item ranked 20th. No statistically significant differences were found according to job position or discipline in the responses to these items.

The item '*sharing authored content*' used the four point 'usefulness' scale; 78% of respondents selected 'quite useful' or 'very useful' for this item, which was ranked 1st in Table 5.2.2. Responses to this item showed statistically significant differences according to job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 445) = 9.852, p = 0.020$). Boxplots of the distribution of responses to this item according to job position from the online survey are shown in Figure 5.2.4.1.

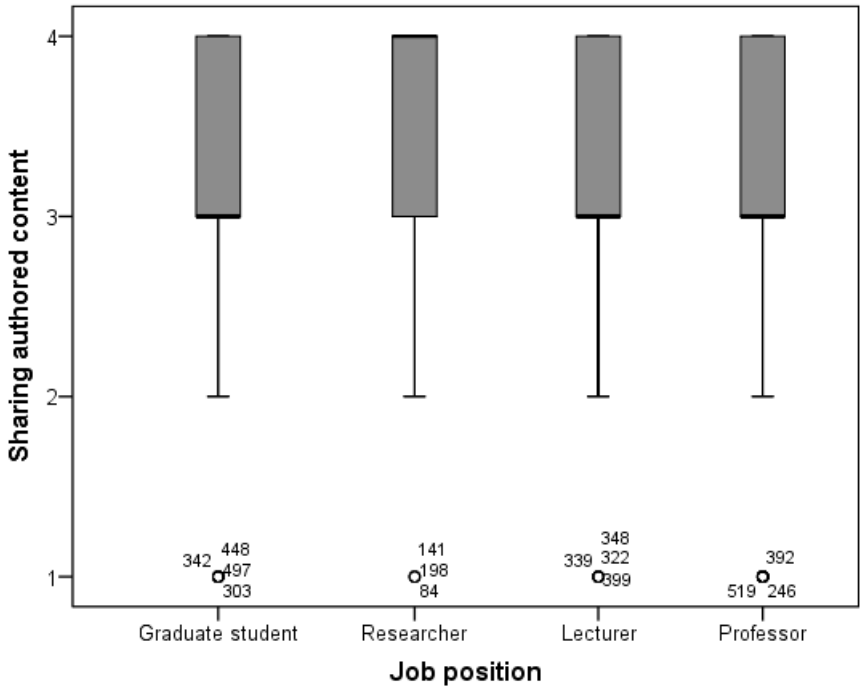


Figure 5.2.4.1: Distribution of responses in the online survey to the item 'sharing authored content' according to job position.
1 = 'not at all useful', 4 = 'very useful'.

The results of post hoc tests are shown in Table 5.2.4.1; these show that agreement with the item is significantly higher for researchers than for professors.

Table 5.2.4.1: Results of post hoc tests on the item 'sharing authored content' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 5560.50 *z* = -1.004 *p* = 0.315	*U* = 10642.50 *z* = -0.265 *p* = 0.791	*U* = 5389.50 *z* = -2.036 *p* = 0.042
Researcher		*U* = 6968.00 *z* = -0.947 *p* = 0.343	***U* = 3355.00** ***z* = -2.927** ***p* = 0.003**
Lecturer			*U* = 6509.00 *z* = -2.500 *p* = 0.012

5.2.5 Gaining information

Four items in the online survey related to gaining information:

- *'Social networking sites are a good way of finding out about new publications of interest' (1 of 24).*
- *'Social networking sites allow me to draw upon a wider community of expertise when I need help' (4 of 24).*
- *'Being able to ask questions of the online community is important' (7 of 24).*
- *'Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading' (17 of 24).*

The items on the theme of gaining information garnered high levels of agreement, with three of the four items being ranked in the top seven in Table 5.2.1. The exception – '*viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading*' – is interesting, as it refers instead to what others have chosen to post on their profiles, rather than

what the academic has set out to find themselves. The high level of agreement overall was consistent, with no significant differences being found for any of the items according to discipline or job position.

5.2.6 Careers

Six Likert scale items in the online survey relate to career development, including two items in the main Likert scale inventory, and a further four items on the 'usefulness' scale adopted from the Nature survey. Most of the items relating to careers showed significant differences according to job position.

In the main Likert scale inventory, '*social networking sites are useful to discover job opportunities'* ranked 12th of 24, and '*having a profile will enhance my future career prospects*' ranked 16th of 24 in Table 5.2.1. The item '*social networking sites are useful to discover job opportunities*' showed significant differences according to both job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 488) = 26.782, p < 0.000$) and discipline (independent samples Kruskal-Wallis test, $\chi 2(4, N = 517) = 11.649, p = 0.020$).

The differences in terms of job position can be attributed to lower agreement levels in professors (Figure 5.2.6.1 and Table 5.2.6.1); in terms of disciplinary differences, Natural Sciences demonstrate a higher level of agreement compare to Professions (Figure 5.2.6.2 and Table 5.2.6.2).

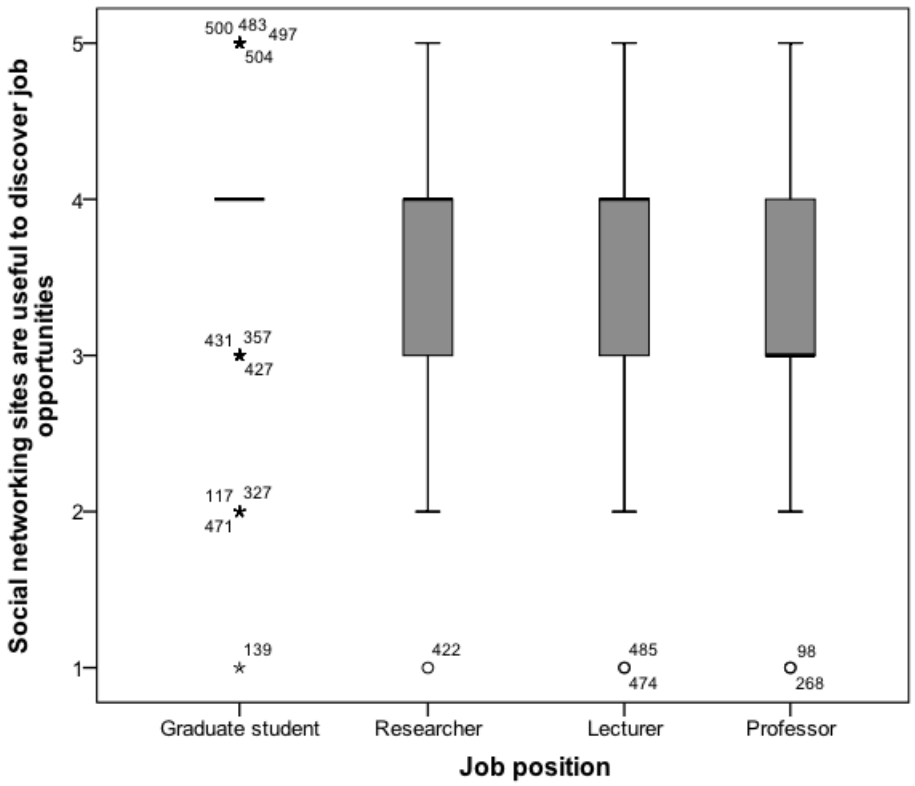


Figure 5.2.6.1: Distribution of responses in the online survey to the item 'social networking sites are useful to discover job opportunities' according to job position.
1 = 'strongly disagree'; 5 = 'strongly agree'.

Table 5.2.6.1: Results of post hoc tests on the item 'social networking sites are useful to discover job opportunities' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 6002.50 *z* = -0.566 *p* = 0.571	*U* = 9390.50 *z* = -2.469 *p* = 0.014	***U* = 4318.50** ***z* = -4.801** ***p* < 0.001**
Researcher		*U* = 6685.00 *z* = -1.553 *p* = 0.120	***U* = 3123.50** ***z* = -3.781** ***p* < 0.001**
Lecturer			***U* = 6254.00** ***z* = -3.007** ***p* = 0.003**

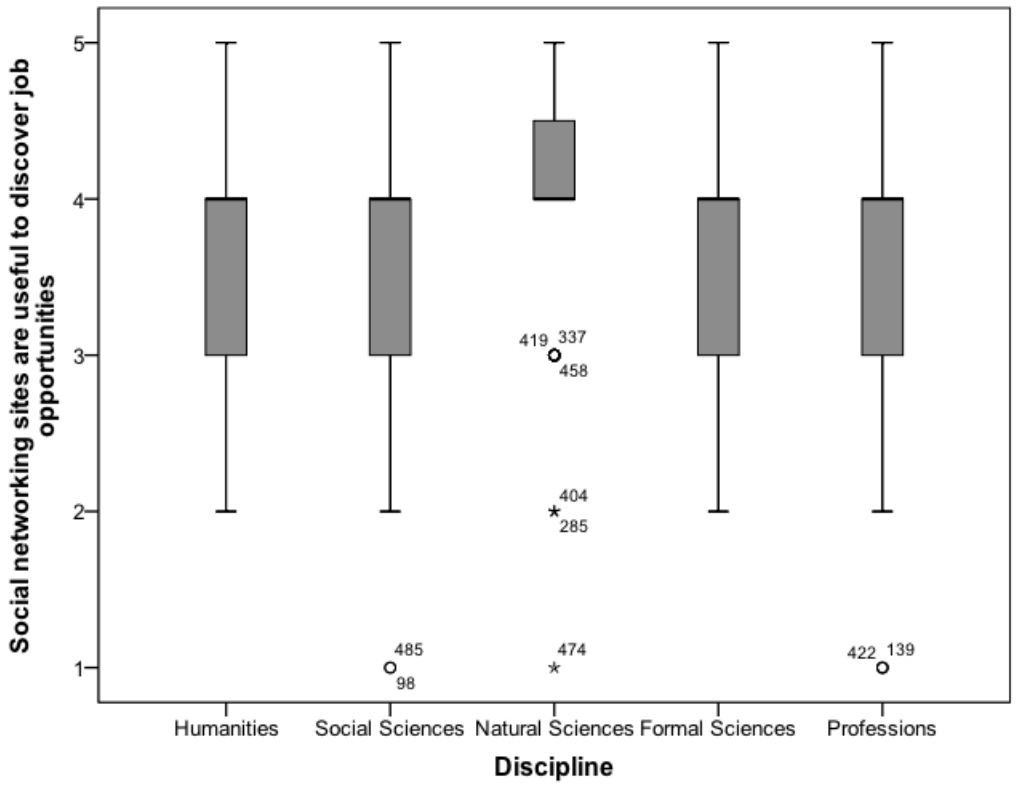


Figure 5.2.6.2: Distribution of responses in the online survey to the item 'social networking sites are useful to discover job opportunities' according to discipline.
1 = 'strongly disagree'; 5 = 'strongly agree'.

Table 5.2.6.2: Results of post hoc tests on the item 'social networking sites are useful to discover job opportunities' according to discipline.
Combinations which yielded significant differences are shown in bold (adjusted α = .005).

Discipline	Social Sciences	Natural Sciences	Formal Sciences	Professions
Humanities	*U* = 6952.50 *z* = -0.726 *p* = 0.468	*U* = 3292.50 *z* = -0.917 *p* = 0.359	*U* = 1029.00 *z* = -1.667 *p* = 0.096	*U* = 7336.50 *z* = -2.051 *p* = 0.040
Social Sciences		*U* = 4654.50 *z* = -1.643 *p* = 0.100	*U* = 1639.00 *z* = -1.284 *p* = 0.199	*U* = 11631.00 *z* = -1.439 *p* = 0.150
Natural Sciences			*U* = 677.00 *z* = -2.254 *p* = 0.024	***U* = 4818.00** ***z* = -2.994** ***p* = 0.003**
Formal Sciences				*U* = 2071.00 *z* = -0.658 *p* = 0.510

'*Having a profile will enhance my future career prospects*' showed significant differences according to job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 487) = 19.801, p < 0.000)$. The distribution of responses according to job position is shown in Figure 5.2.6.3.

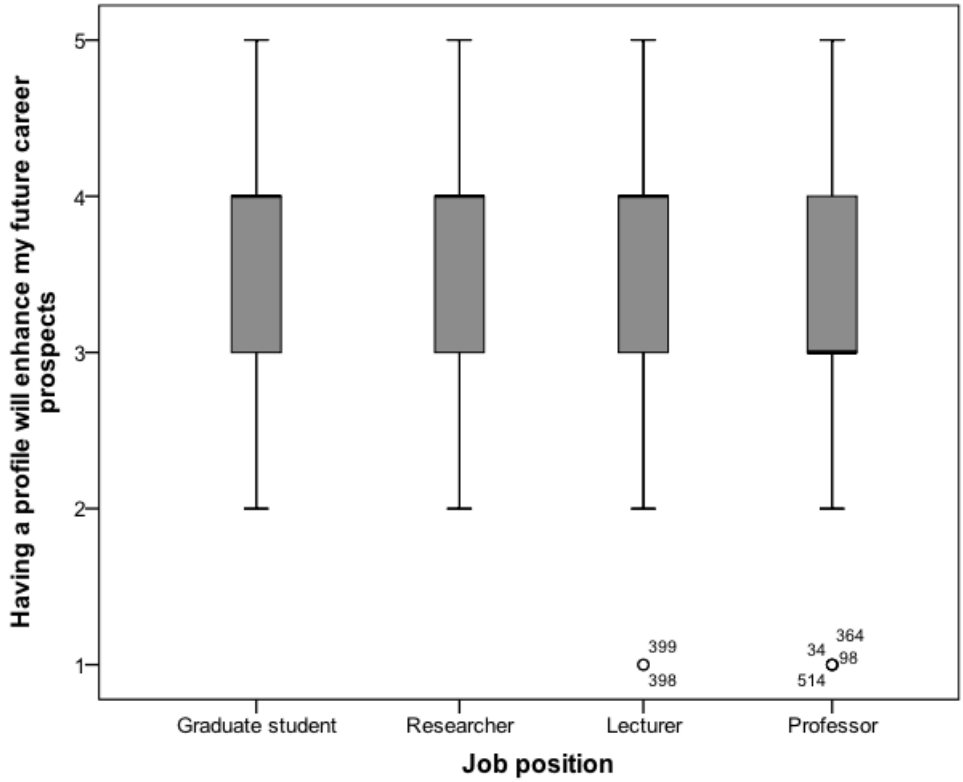


Figure 5.2.6.3: Distribution of responses in the online survey to the item 'having a profile will enhance my future career prospects' according to job position.
1 = 'strongly disagree'; 5 = 'strongly agree'.

Professors demonstrate a median agreement of 'neither agree nor disagree', while all other groups 'agree'.

Post hoc tests are summarised in Table 5.2.6.3.

Table 5.2.6.3: Results of post hoc tests on the item 'having a profile will enhance my future career prospects' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 6205.00 *z* = -0.115 *p* = 0.909	*U* = 9271.50 *z* = -2.180 *p* = 0.029	***U* = 4640.00** ***z* = -4.002** ***p* < 0.001**
Researcher		*U* = 6560.00 *z* = -1.769 *p* = 0.077	***U* = 3192.00** ***z* = -3.471** ***p* = 0.001**
Lecturer			*U* = 6553.00 *z* = -2.307 *p* = 0.021

This shows that the significant differences can be attributed to the lower agreement level of professors with the statement, compared to graduate students and researchers.

The following items relate to careers and were rated on the alternative 'usefulness' Likert scale (Table 5.2.2):

- *'Raising the profile of your work in the research community' (76.7% 'quite useful' or 'very useful').*
- *'Raising your personal profile in the research community' (76.5%).*
- *'Attracting future employers' (33.3%).*
- *'Attracting funding' (10.4%).*

The item '*raising the profile of your work in the research community*' showed significant differences according to job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 441) = 18.280, p < 0.000)$; researchers show a higher level of agreement (Figure 5.2.6.4).

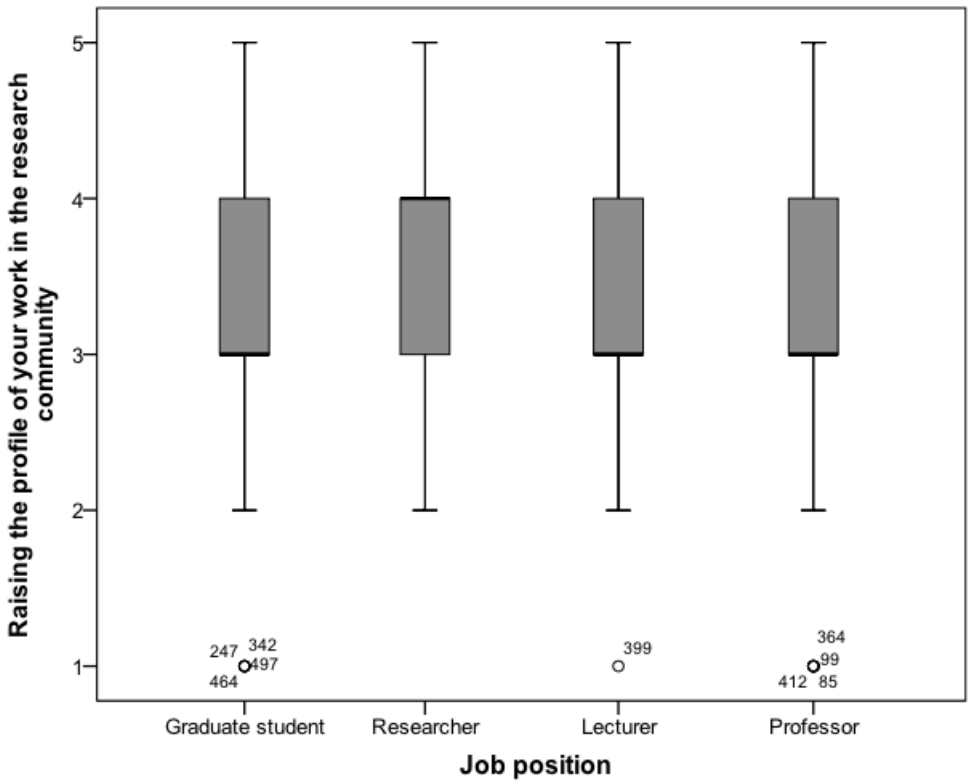


Figure 5.2.6.4: Distribution of responses in the online survey to the item 'raising the profile of your work in the research community' according to job position.
1 = 'strongly disagree'; 5 = 'strongly agree'.

The post hoc tests confirm that researchers show a higher level of agreement with the statement than all of the other groups (Table 5.2.6.4).

Table 5.2.6.4: Results of post hoc tests on the item 'raising the profile of your work in the research community' according to job position.
Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	***U* = 4860.00** ***z* = -2.792** ***p* = 0.005**	*U* = 10658.50 *z* = -0.360 *p* = 0.719	*U* = 6047.00 *z* = -0.722 *p* = 0.470
Researcher		***U* = 6046.00** ***z* = -2.840** ***p* = 0.005**	***U* = 3272.50** ***z* = -3.268** ***p* = 0.001**
Lecturer			*U* = 7264.00 *z* = -1.111 *p* = 0.267

The item '*attracting future employers*' showed significant differences according to job position (independent samples Kruskal-Wallis test, $\chi 2(3, N = 333) = 22.136, p<.000)$ surveys. This illustrates a trend according to seniority; graduate students showing the highest levels of agreement, and professors the lowest (Figure 5.2.6.5).

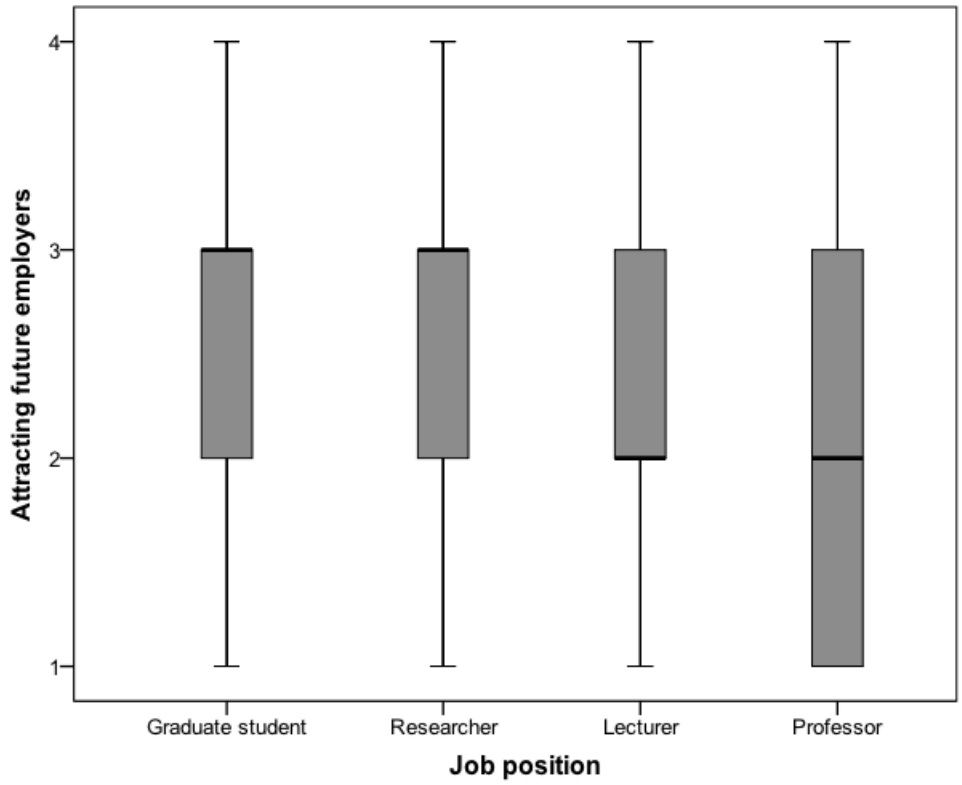


Figure 5.2.6.5: Distribution of responses in the online survey to the item 'Attracting future employers' according to job position.
1 = 'not at all useful', 4 = 'very useful'.

The trend is confirmed statistically via post hoc tests (Table 5.2.6.5). The differences between adjacent job categories (e.g. graduate student-researcher) are not significant, but those between more distance job categories (e.g. graduate student-lecturer) are.

Table 5.2.6.5: Results of post hoc tests on the item 'attracting future employers' according to job position.

Combinations which yielded significant differences are shown in bold (adjusted α = .0083).

Job position	Researcher	Lecturer	Professor
Graduate student	*U* = 2450.00 *z* = -1.373 *p* = 0.170	***U* = 3985.50** ***z* = -2.653** ***p* = 0.008**	***U* = 1660.50** ***z* = -4.451** ***p* < 0.001**
Researcher		*U* = 3454.00 *z* = -1.074 *p* = 0.283	***U* = 1469.00** ***z* = -3.133** ***p* = 0.002**
Lecturer			*U* = 2981.00 *z* = -2.520 *p* = 0.012

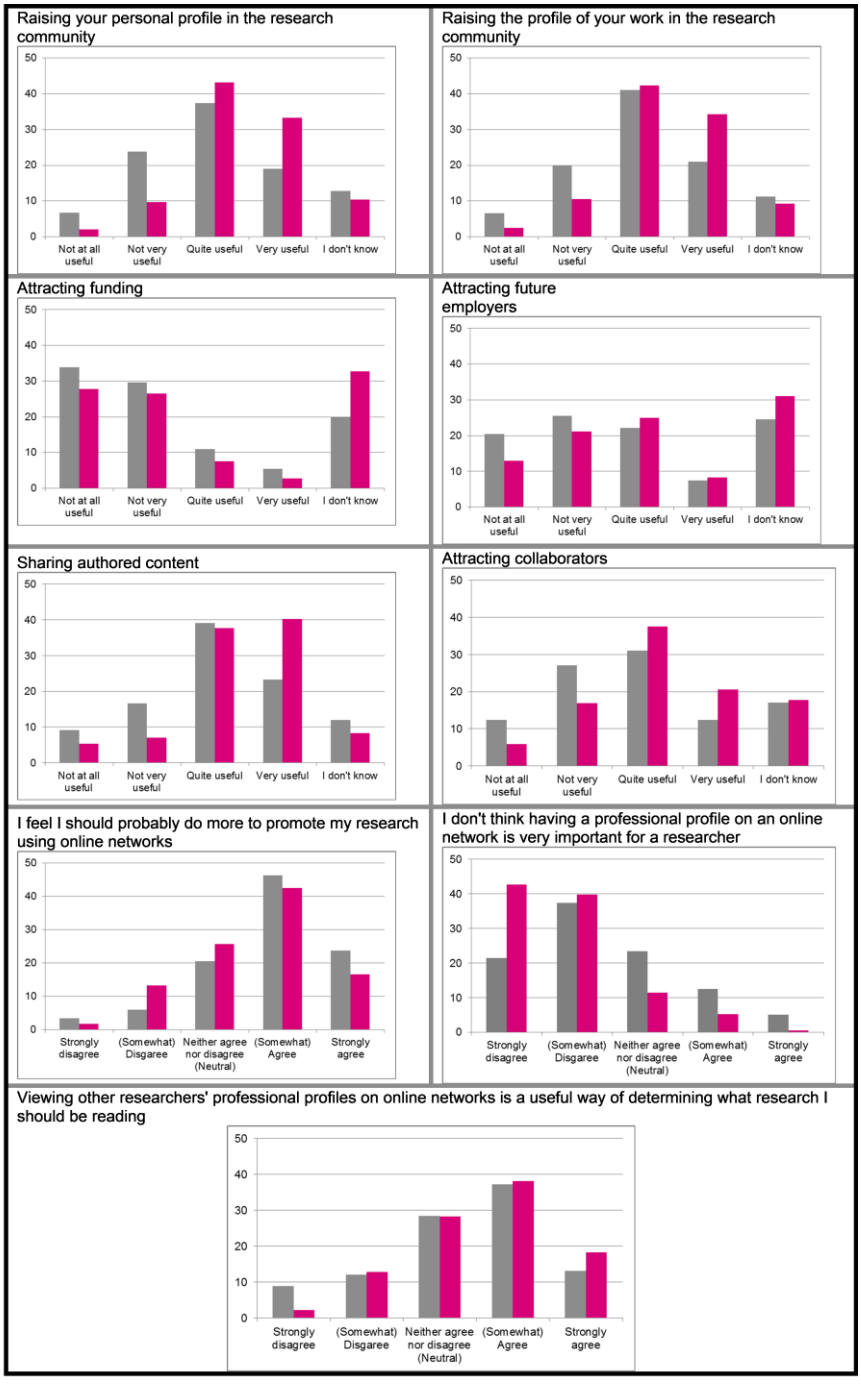
5.3 Comparison with an independent dataset

As discussed in Chapter 4, comparison between the online survey and the Nature survey dataset (Van Noorden, 2014) offered the opportunity to validate the tool against a larger sample. Distribution of responses to the identical items used in both surveys are shown in Table 5.3.1.

Full data for the responses of identical questions across both survey dataset is shown in Appendix E.

Table 5.3.1: *Direct comparison of the identical Likert scale questions from the Nature survey (grey bars) and the online survey (pink bars).*

Bars are shown as a percentage of responses per survey (Nature survey N = 3508; online survey N = 528)



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Although the responses to each survey differ to an extent – the online survey participants generally show a higher level of agreement with the survey items – the trends in responses were consistent across both datasets. When ranked in descending order of agreement, the items follow the same order in both survey datasets (Table 5.3.2).

Table 5.3.2: Ranking in descending order in terms of agreement level of the identical Likert scale questions from both the Nature survey and the online survey.

	Nature survey	Nature survey ranking	Online survey	Online survey ranking
% Quite or very useful				
Raising your personal profile in the research community	56.6	3	76.5	3
Raising the profile of your work in the research community	62.0	2	76.7	2
Attracting funding	16.5	6	10.4	6
Attracting future employers	29.4	5	33.3	5
Sharing authored content	62.4	1	78.0	1
Attracting collaborators	43.5	4	58.1	4
% Somewhat or strongly agree				
Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	50.5	2	56.3	2
I feel I should probably do more to promote my research using online networks	70.0	1	59.1	1
I don't think having a professional profile on an online network is very important	17.7	3	5.9	3

There were also some demographic differences in the responses to each survey. As a Nature initiative, the majority of respondents to their survey (2107; 60%) were from subject areas allied with Natural Sciences (compared to 72, or 14%, of the online survey), whereas Humanities and Social Sciences were better represented

in the online survey (248, or 47% in the online survey, compared to 366 or 10% in the Nature survey). However, there is not a consistent pattern when comparing disciplinary differences in both survey datasets (Table 5.3.2).

Table 5.3.2: Summary of statistically significant differences according to discipline for items used in both the Nature and the online surveys.

Full details of the statistical tests for the online survey are given elsewhere in the current chapter; detailed results of the Nature survey tests are shown in Jordan (2014b).

Item	Differences according to Discipline		
	Nature survey	**Online survey**	**Note**
Raising your personal profile in the research community	No significant differences	No significant differences	
Raising the profile of your work in the research community	No significant differences	No significant differences	
Attracting funding	Significant differences	No significant differences	Lower agreement in Humanities and Social Sciences in the Nature survey
Attracting future employers	Significant differences	No significant differences	Lower agreement in Humanities and Social Sciences in the Nature survey
Sharing authored content	No significant differences	No significant differences	
Attracting collaborators	Significant differences	No significant differences	Lower agreement in Humanities and Social Sciences in the Nature survey
Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	Significant differences	No significant differences	Lower agreement in Natural Sciences
I feel I should probably do more to promote my research using online networks	No significant differences	Significant differences	Lower agreement in Formal Sciences in the online survey
I don't think having a professional profile on an online network is very important	No significant differences	No significant differences	

One aspect in which disciplinary differences are consistent across both surveys is in relation to preferred academic SNS platforms. Consistent across both surveys, Academia.edu is more popular with Humanities and Social Sciences (Figure 5.3.1), while ResearchGate is favoured by Formal and Natural Sciences (Figure 5.3.2).

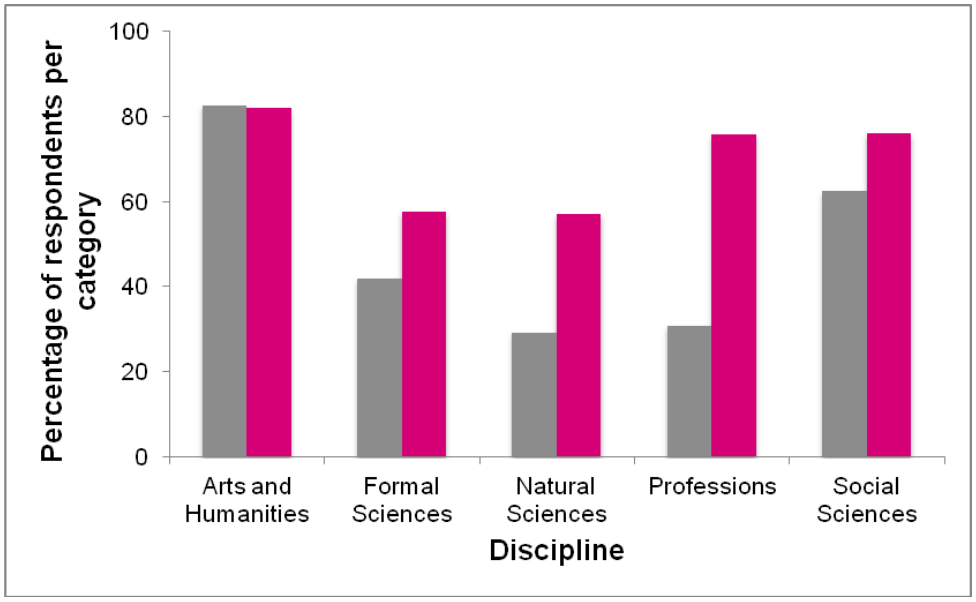


Figure 5.3.1: Percentage of respondents per discipline who were aware of (Nature survey; grey bars) or have ever used (online survey; pink bars) the academic SNS Academia.edu.

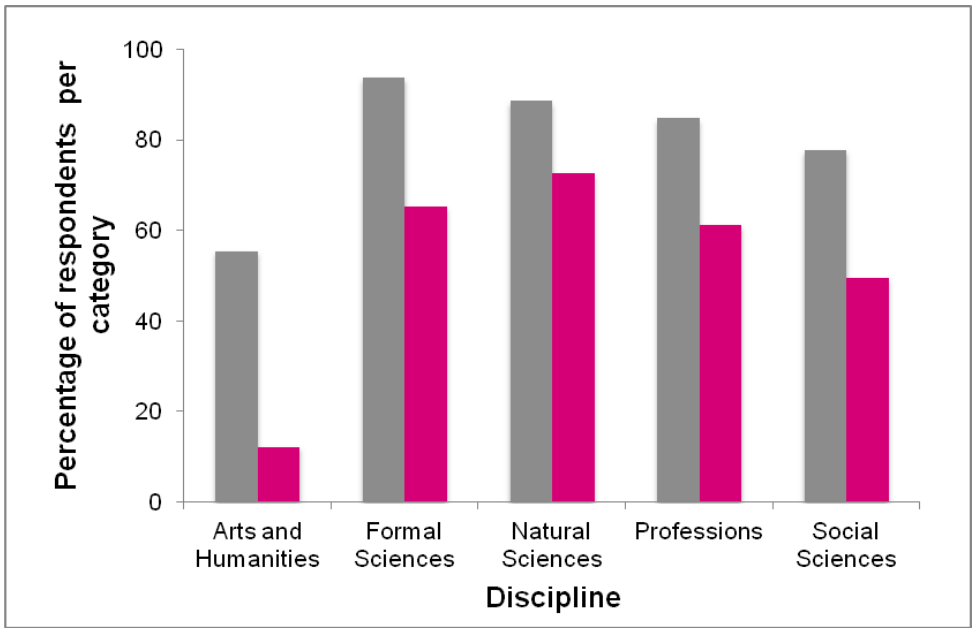


Figure 5.3.2: Percentage of respondents per discipline who were aware of (Nature survey; grey bars) or have ever used (online survey; pink bars) the academic SNS ResearchGate.

It is likely that the generally more positive responses from the online survey compared to the Nature survey result from differences in the ways that each survey was promoted. Both were undertaken using online survey software. The Nature survey was primarily circulated via email lists; information about the online survey was posted on major professional SNS and received particular uptake on Twitter. Thus, the online survey is likely to have attracted responses from a sample of academics who use social media more actively and are therefore more likely to find it to be useful. Despite this higher level of agreement overall in the online survey data, the relative importance of different items is consistent across both datasets (Table 5.3.2).

5.4 Summary

The survey data findings are discussed briefly here in relation to the RQs, before proceeding to examine the network analysis data (Chapter 6). Although the primary aim of the survey was as a means of recruiting participants for network analysis and interviews, the findings provide a degree of insight into the RQs at a broader, contextual level, and allow a mechanism for situating the dataset against a larger independent sample.

5.4.1 What are the structural characteristics of academics' online ego-networks on social networking sites?

The structure of academics' online networks was not addressed explicitly by the surveys. This question is addressed specifically via the SNA data, to follow in Chapter 6.

5.4.2 How do academics construct and understand their ego-networks?

In relation to construction of networks, four questions addressed network-forming behaviour (Section 5.2.2). Statements which related to career progression and experience – making connections with those you have worked with or would like to work with – showed higher agreement levels than following those who have followed you, or only those they know personally.

While the survey does not address interpreting network structure, the data do provide information about the roles that academics' online networks play. Profiles are viewed prevalently as a passive medium; 76.6% of respondents to the online survey agree or strongly agree that '*I see my profile as an online business card*', while 13.4% agree or strongly agree that '*I use my profile as a research journal*'.

However, 82.6% of respondents disagree or strongly disagree with the statement '*I don't think having a professional profile on an online network is very important*'.

Overall, responses to a range of different purposes for which academics could use SNS showed positive skews (Section 5.2). Survey items relating to collaboration and gaining information showed some of the highest levels of agreement. The item '*my online academic and personal identities are separated*' is an interesting exception, demonstrating a bimodal distribution at 'disagree' and 'agree'. The only items which showed negative skews (apart from the negatively-worded statement about importance) were '*attracting funding*' and '*attracting future employers*'.

5.4.3 Does the structure and/or role of the network differ in nature according to academic career trajectories?

Awareness and use of academic SNS in particular shows a clear disciplinary divide, which may reflect the origins of each platform. Academia.edu is more popular with the Arts and Humanities, while ResearchGate is favoured by Formal and Natural Sciences. Social Sciences are present at an intermediate level on both platforms. This is borne out by both the online survey and Nature survey (Figures 5.3.1 and 5.3.2), and was important to consider when sampling networks (Section 4.3.2).

Five of the 30 Likert scale items showed significant differences according to discipline (summarised in Table 5.4.3.1). However, a consistent picture does not emerge in the findings; that is, the items showing significant differences are not clustered around a particular theme, or showing consistent divides according to particular disciplines. Note that the sample size for Formal Sciences is relatively small, so may be more influenced by outliers.

Table 5.4.3.1: Overview of Likert scale survey items which exhibited significant differences according to discipline.

Item	Type of relationship
I use social networking sites to support my teaching activities	Median 'agree' for all except Natural Sciences ('neither agree nor disagree').
I feel I should probably do more to promote my research using online networks	Median 'agree' for all except Formal Sciences ('neither agree nor disagree').
I use social networking sites to discover peers working in my field of research	Median 'agree' across all disciplines. Distribution shows lower agreement in Social Sciences and Professions.
Social networking sites are a useful way to support working in collaboration with other researchers	Median 'agree' across all disciplines. Distribution shows higher agreement in Social Sciences and Professions.
Social networking sites are useful to discover job opportunities	Median 'neither agree nor disagree' across all disciplines. Distribution shows higher agreement in Natural Sciences.

Eight of the 30 Likert scale items in the online survey showed significant differences according to job position (Table 5.4.3.2). Different themes appear to be of significance at different career stages, and this is also reflected in the network structures and strategies which emerged from the interviews in terms of engaging with and building their online networks (Chapters 7 and 8).

Table 5.4.3.2: Overview of Likert scale survey items which exhibited significant differences according to job position.

Item	Type of relationship
I use social networking sites to support my teaching activities	Median 'agree' for professors and lecturers; 'neither agree nor disagree' for graduate students and researchers.
I follow people who I would like to work with in the future	Median 'agree' for graduate students, researchers, and lecturers; 'neither agree nor disagree' for professors.
Sharing authored content	Median 'agree' for researchers; 'neither agree nor disagree' for all others.
Having a profile will enhance my future career prospects	Median 'neither agree nor disagree' for professors; 'agree' for all others.
Raising the profile of your work in the research community	Median 'agree' for Researchers; 'neither agree nor disagree' for all others.
Social networking sites are useful to discover job opportunities	Median 'neither agree nor disagree' for professors; 'agree' for all others.
Attracting future employers	Median 'neither agree nor disagree' for graduate students and researchers'; median 'disagree' for professors and lecturers.

Items relating to career development show consistent differences according to job position, being of greater importance to more junior academics and students. This includes the items '*I follow people who I would like to work with in the future*', '*Having a profile will enhance my future career prospects*', '*social networking sites are useful to discover job opportunities*', and '*attracting future employers*'. In contrast, the item '*I use social networking sites to supporting my teaching activities*' shows higher agreement levels for more senior academics, likely to have

greater teaching loads (professors and lecturers). Dissemination appears to be of particular importance to researchers, with higher levels of perceived usefulness in terms of '*sharing authored content*' and '*raising the profile of your work in the research community*'. These observations illustrate that academics' use of SNS is perceived to be beneficial in different ways at different stages of an academic career.

6. Results: Personal network structures

In the previous chapter, the survey data were presented and analysed. This provided a layer of context, about how academics use SNS, and identified aspects in which differences exist according to discipline or job position. In addition to providing this contextual information, the survey also served to recruit participants to take part in the second research phase: SNA of their online networks. While the previous chapter assisted in addressing RQs 2 and 3, the focus now turns to RQ1 (see Figure 4.3.1). This chapter focuses upon the structural characteristics of academics' personal (ego) networks on online social networking platforms. For a sample of 55 academics, drawn from the pool of survey respondents, two networks were sampled and analysed: Twitter, and either Academia.edu or ResearchGate, as an academic SNS. Basic SNA metrics provide insights into network structures, which are examined across contrasting disciplines and academic job positions.

Analyses appropriate to personal network data comprise three types (Borgatti, Everett & Johnson, 2013; DeJordy & Halgin, 2008; Prell, 2012):

- *Size*: Number of nodes, degree, in-degree, out-degree, number of communities.
- *Structure*: Density, betweenness centrality, brokerage, reciprocity.
- *Composition*: Homophily, heterogeneity.

For each participants' pair of networks, the following SNA metrics were generated based on their network graphs: number of nodes, degree, in-degree, out-degree, and number of communities (network size); network density, reciprocity,

betweenness centrality and brokerage (network structure). Network composition was addressed to an extent in a qualitative manner by identification and interpretation of network structures from the participants' viewpoints in the co-interpretive interviews. For all metrics, the possibility of differences according to job position or discipline was interrogated using nonparametric statistical tests. Nonparametric tests were chosen due to several metrics following non-normal distributions (Field, 2009). The tests used examined differences by comparing medians (independent samples median test) and distribution (independent samples Kruskal-Wallis test) of the data for each metric. Trends are identified for further discussion about their implications for academic networking online, and questions raised for co-interpretive interviews (to be discussed in Chapter 7).

6.1 Characteristics of the network datasets

Network data was collected for a total of 55 academics, between March and July 2015. The approach to sampling has been described in detail in Chapter 4, however the characteristics of the sample are summarised here in Table 6.1.1 (a full list of participants' IDs, job positions, discipline, subject and academic SNS is shown in Appendix F). The sample was designed to include three categories of academic discipline (Arts and Humanities, Natural Sciences, and Social Sciences) and four categories of job position (graduate student, researcher, lecturer, and professor) to ensure that a range of perspectives were represented. Drawing upon the results of the survey analyses (Chapter 5), two networks were sampled for each participant: Twitter, and an academic SNS (either Academia.edu or ResearchGate depending on which they use, as the sites differ in popularity according to discipline). Use of Academia.edu and ResearchGate reflected

disciplinary differences shown in Chapter 4; all Arts and Humanities participants' academic SNS networks were sampled from Academia.edu, while 14 out of 20 Social Sciences networks and four out of 16 Natural Sciences networks were from Academia.edu (the remainder being from ResearchGate).

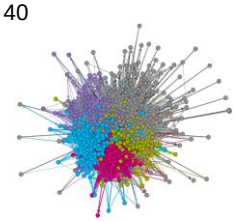
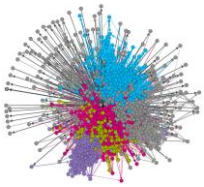
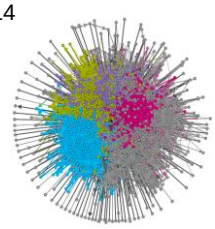
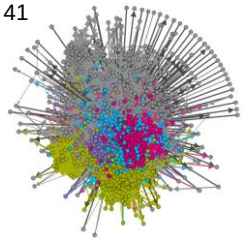
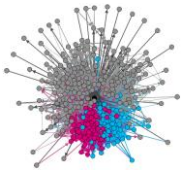
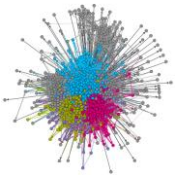
Table 6.1.1: Summary of participants included in network data collection and analysis. Bracketed numbers show ID numbers for participants in each group.

		Job position				Total
		Graduate student	**Researcher**	**Lecturer**	**Professor**	
Discipline	Arts & Humanities	5 (13,40,41,42,43)	5 (36,37,38,39,55)	5 (32,33,34,35,53)	3 (1,2,31)	**18**
	Natural Sciences	4 (27,28,29,30)	3 (10,25,26)	5 (7,21,22,23,24)	4 (17,18,19,20)	**16**
	Social Sciences	6 (14,15,16,44,45,46)	6 (9,11,12,47,48,54)	5 (5,6,8,49,50)	4 (3,4,51,52)	**21**
Total		**15**	**14**	**15**	**11**	**54**

6.1.1 Twitter data

Twitter-based personal networks were sampled in full for a total of 47 academics. Due to the restrictions that NodeXL places upon its access to the Twitter API, it was not possible to collect accurate network data for the largest networks. For followers or following values over 2,000 people, NodeXL would not return the full list of users. This was verified by comparing the size of the list of users returned by collecting data through NodeXL to the number of followers and following as stated on the participants' Twitter profile page. Nine participants were affected by this; data about degree, in-degree and out-degree was collected manually from their profile pages, but no network graphs could be created for these participants so they were excluded from the other analyses. The Twitter data for all participants is

shown in Appendix F and network graphs (arranged in tables according to job position) are shown in Figures 6.1.1.1 to 6.1.1.4.

Arts & Humanities	Natural Sciences	Social Sciences
40 	29 	14 
41 	30 	16 
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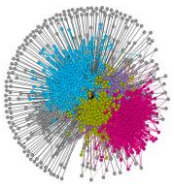
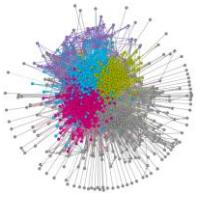
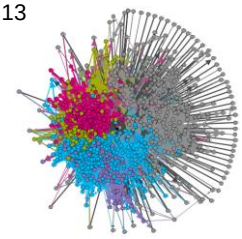
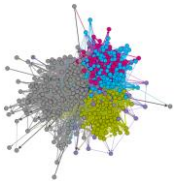
43 		45 
13 		46 
		15 

Figure 6.1.1.1: Graduate students' Twitter network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

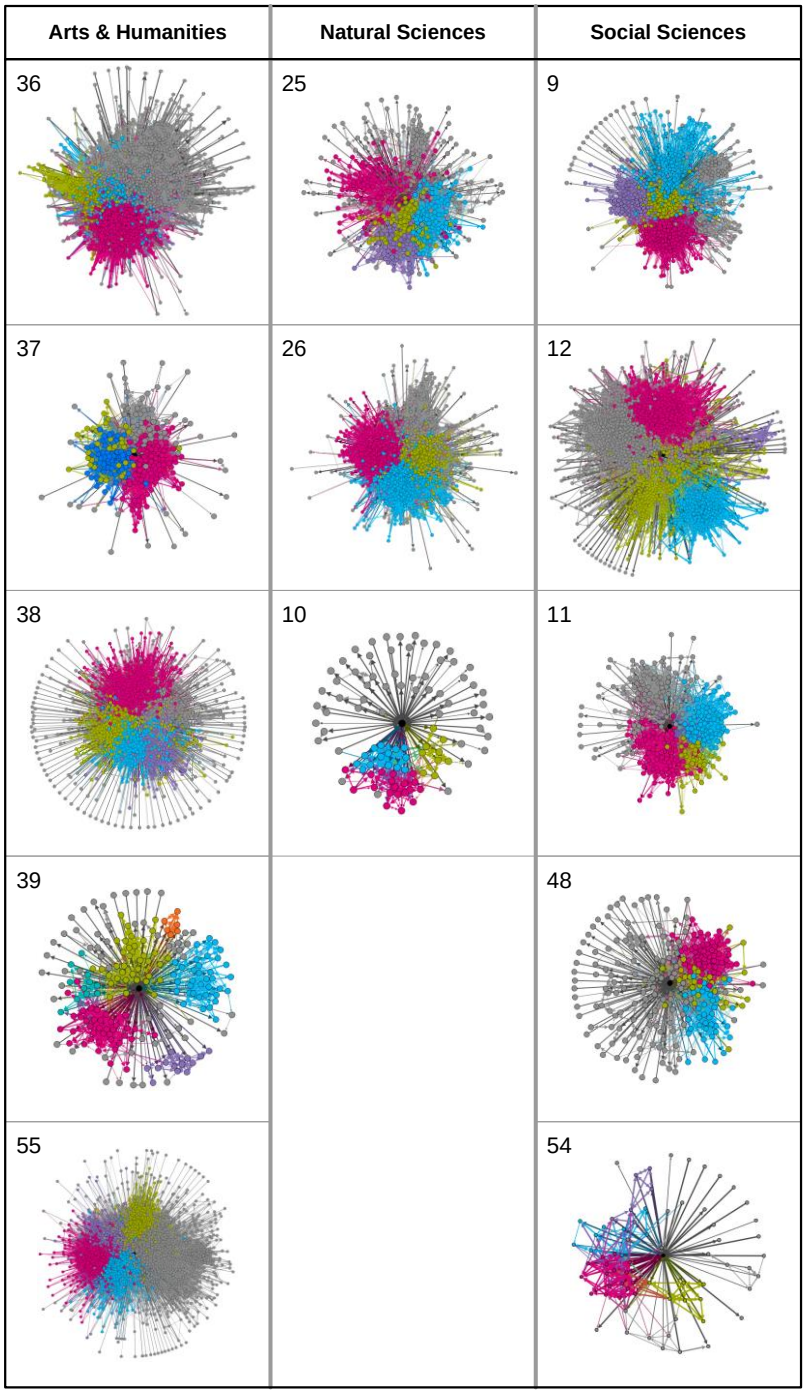


Figure 6.1.1.2: Researchers' Twitter network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

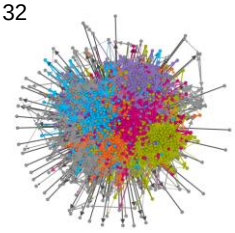
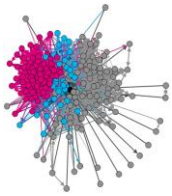
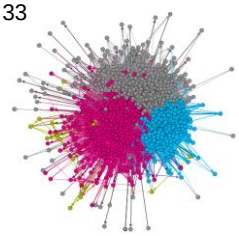
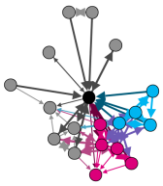
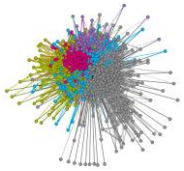
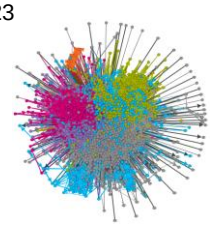
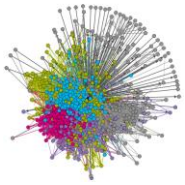
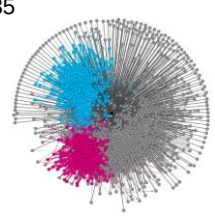
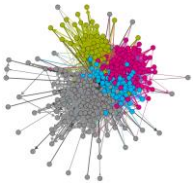
Arts & Humanities	Natural Sciences	Social Sciences
32 	21 	5 
33 	22 	6 
34 	23 	49 
35 	24 	50 
53 		

Figure 6.1.1.3: Lecturers' Twitter network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

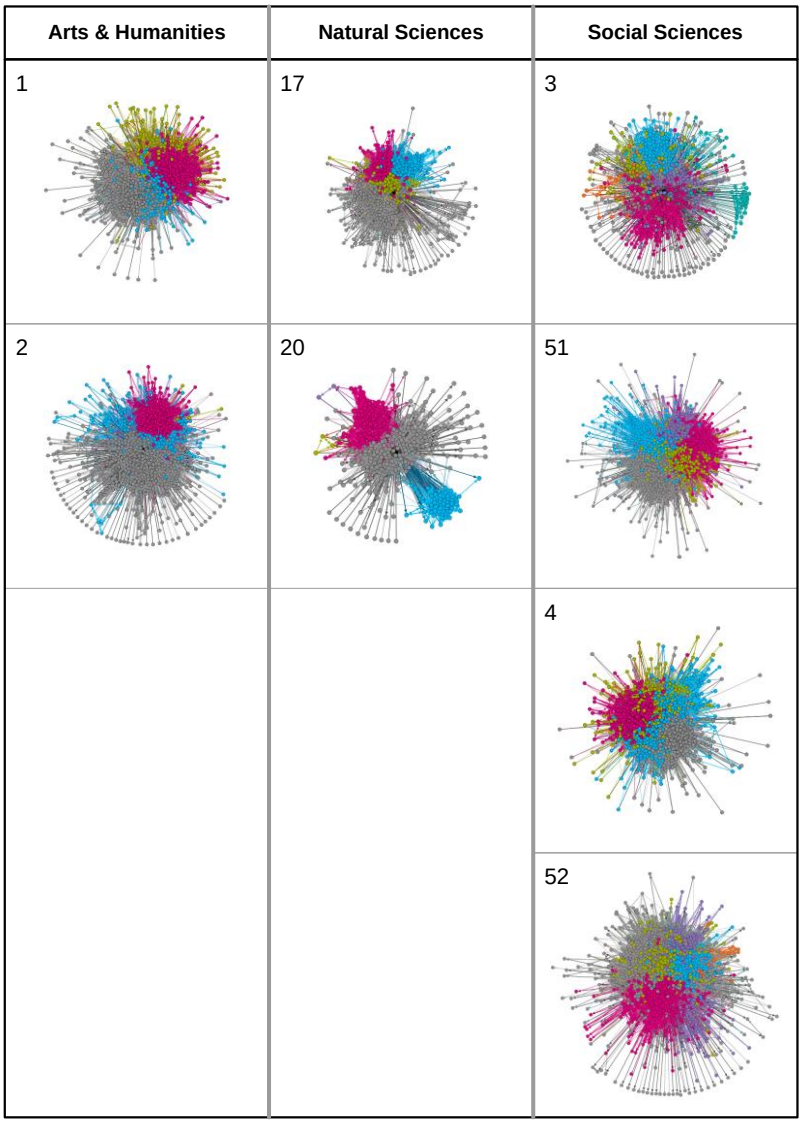


Figure 6.1.1.4: Professors' Twitter network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

6.1.2 Academic social networking sites data

SNA metrics for the 55 academic SNS networks are shown in Appendix F. Network graphs for all participants are shown, arranged in tables according to job position, in Figures 6.1.2.1 to 6.1.2.4.

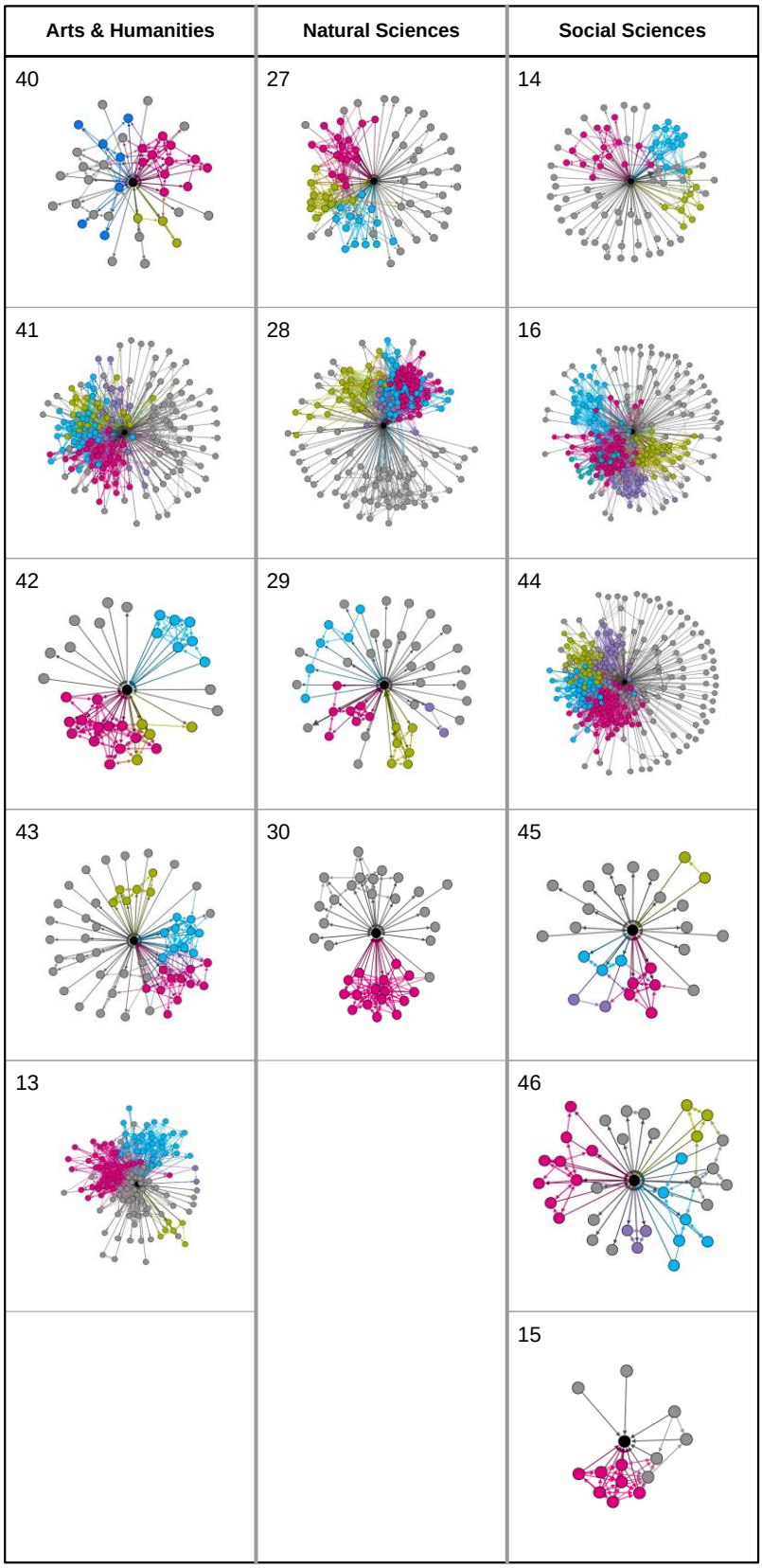


Figure 6.1.2.1: Graduate students' academic social network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

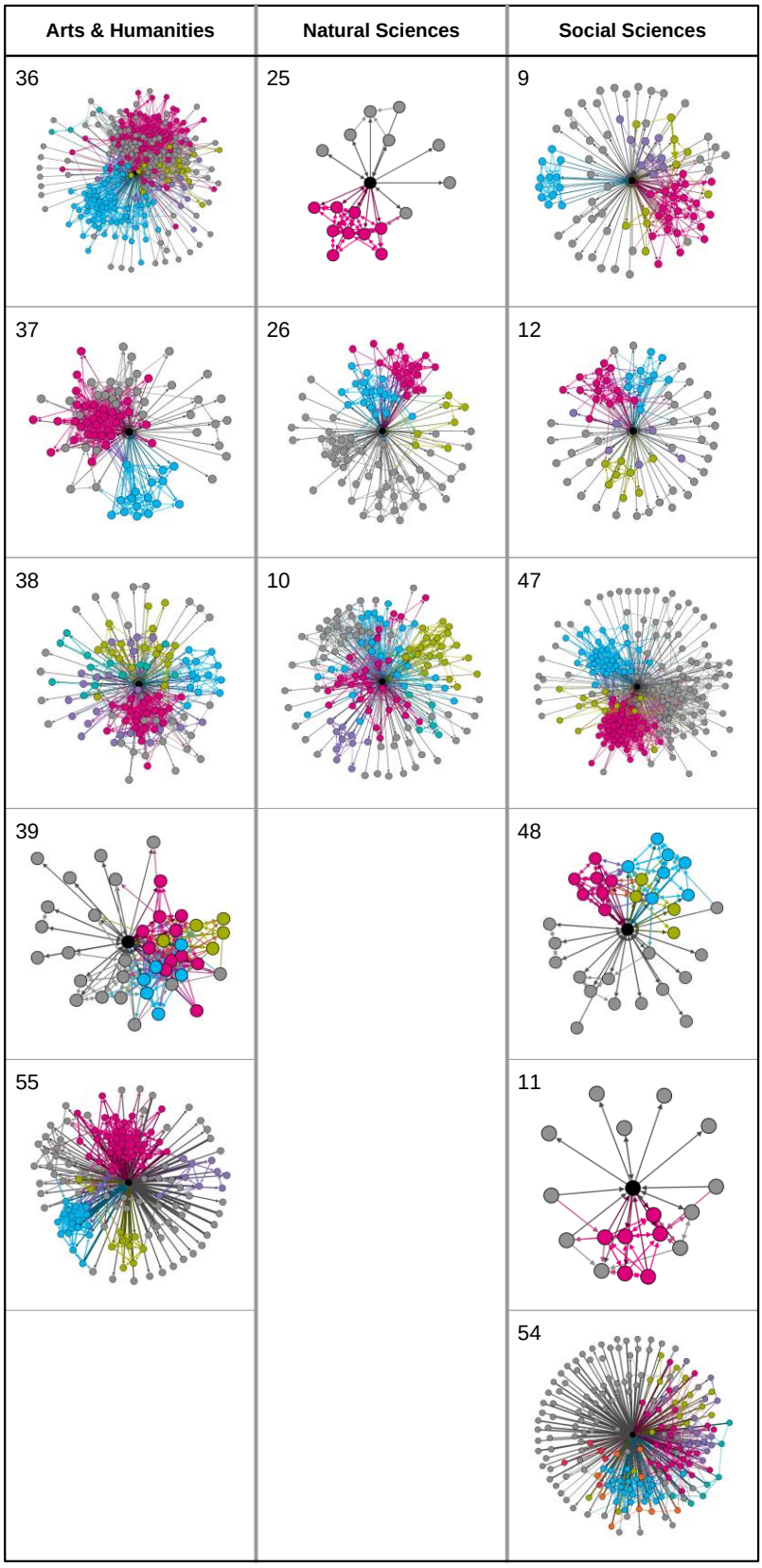


Figure 6.1.2.2: Researchers' academic social network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

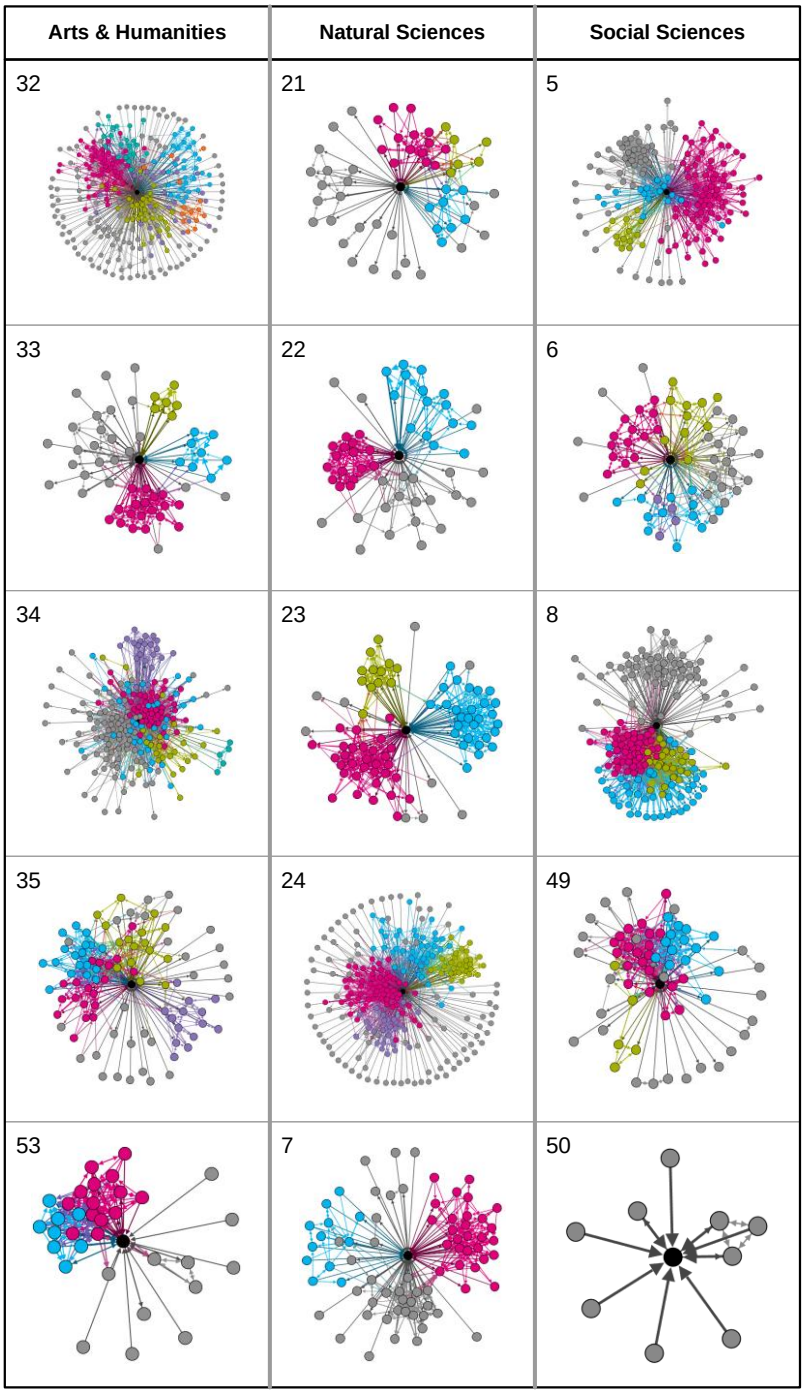


Figure 6.1.2.3: Lecturers' academic social network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

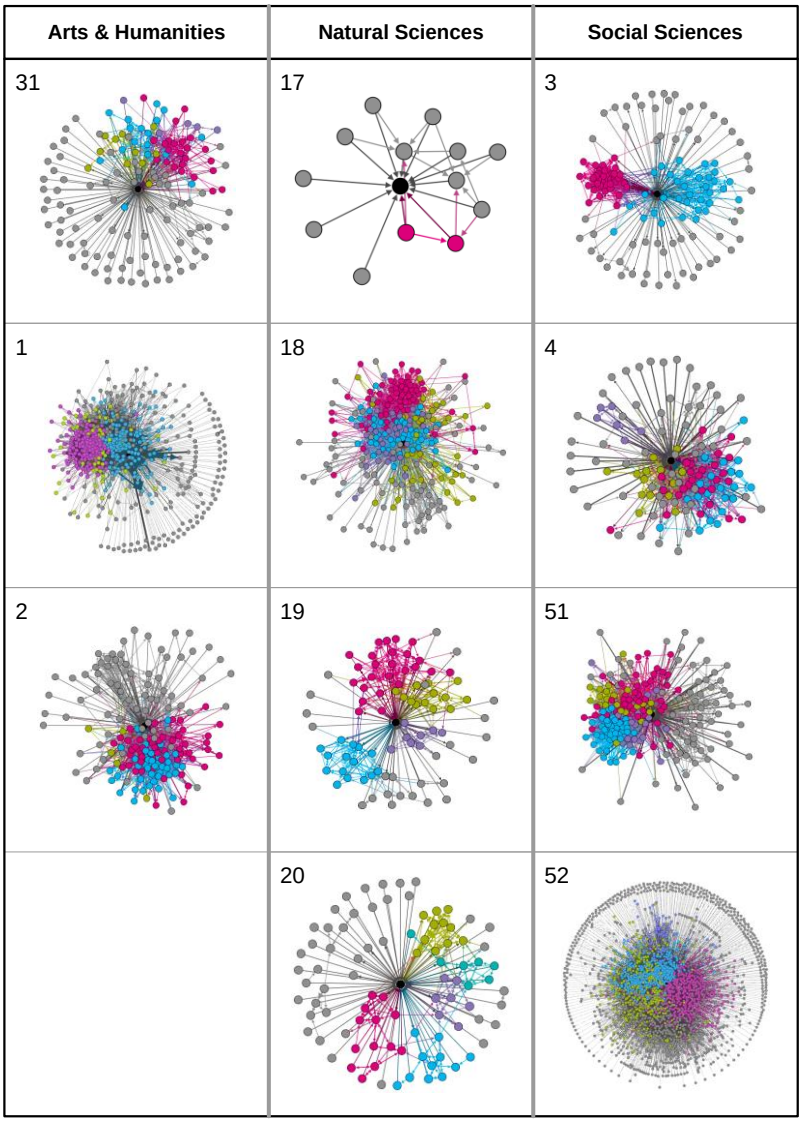


Figure 6.1.2.4: Professors' academic social network graphs.
Ego is shown in black and other nodes colour-coded according to communities.

6.2 Network size

Size is assessed by two types of measure: the number of people (nodes) in ego's personal network, and the number of communities in the network.

6.2.1 Nodes and degree

The most basic measure of network size is the number of nodes – that is, the number of people - present in the network. Network size can be indicative of having influence, being able to disseminate information more widely, or being able to draw upon a larger pool of expertise. Degree considers network size in terms of the number of connections between 'ego' and their 'alters' (people they are connected to). A hallmark of social networks is that degree distributions are steeply unequal with heavy tails (Figure 6.2.1.1); that is, a high proportion of the nodes have a low degree, while there will always be a small proportion with a very high degree (Barabasi, 2011).

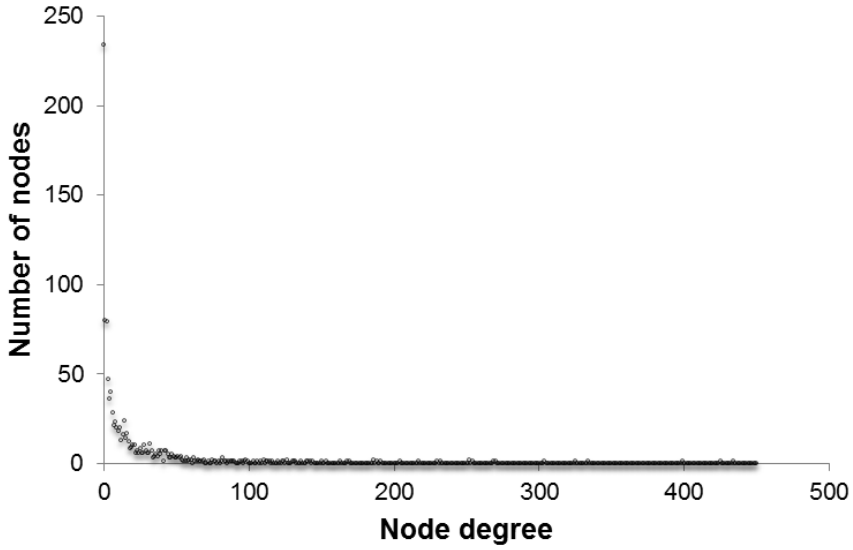


Figure 6.2.1.1: Example of a highly-unequal heavy-tailed degree distribution.

As all of the networks being sampled are directed (that is, a connection between two nodes is a follower/following relationship rather than a mutual, undirected one), degree can be examined both in terms of in-degree (number of followers) and out-degree (number of people who ego is following). Degree is the sum of in-degree and out-degree and reflects the total number of connections that ego has.

Histograms of network sizes of academic SNS and Twitter networks are shown in Figures 6.2.1.2 and 6.2.1.3 respectively.

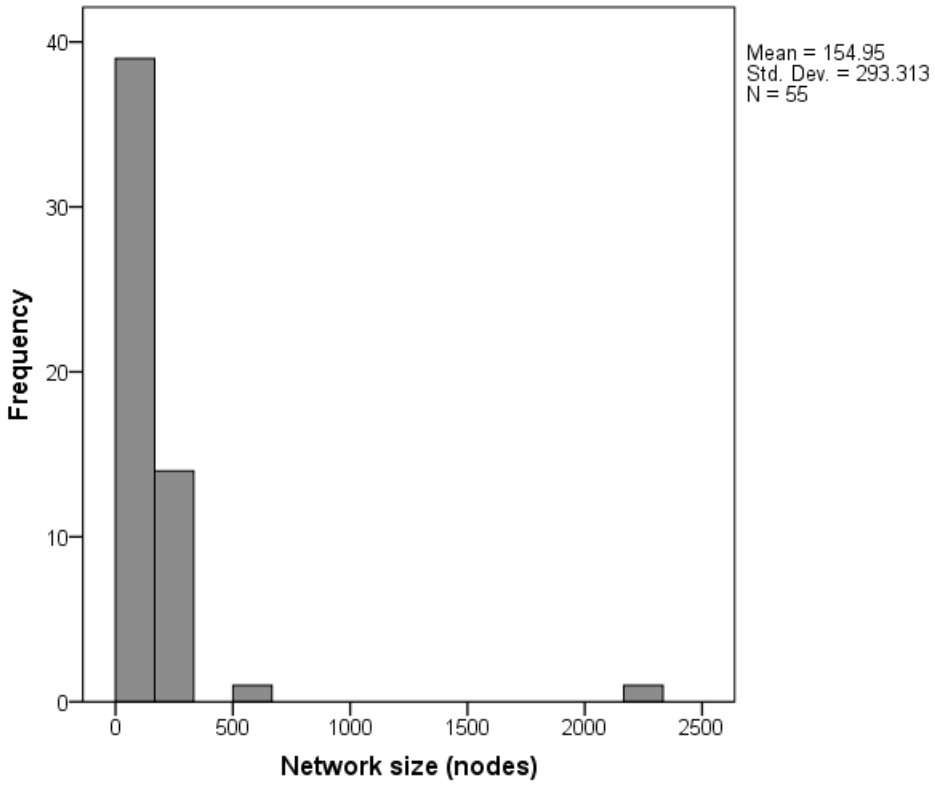


Figure 6.2.1.2: Distribution of network sizes for academic SNS networks.

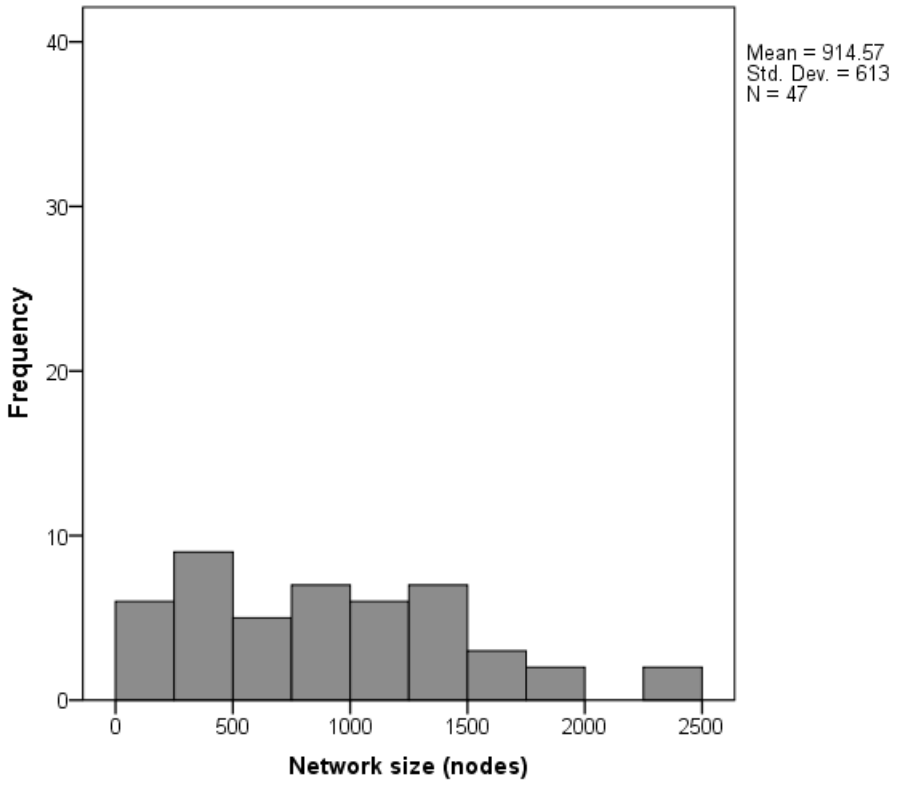


Figure 6.2.1.3: Distribution of network sizes for Twitter networks.

Twitter networks are typically much larger than academic SNS networks (academic SNS median = 91, interquartile range = 121.5, N = 55; Twitter median = 894, interquartile range = 935.5, N = 47). There is a significant correlation between size of networks on both platforms (Spearman's coefficient of rank correlation, r_s=.47, p<.05).

As the data does not exhibit a normal distribution, nonparametric statistics were used to test for differences according to discipline or job position. While no significant differences in network size were found for either site, the average academic SNS network size illustrates a trend towards increasing size with academic seniority (Figure 6.2.1.4), in contrast to Twitter networks (Figure 6.2.1.5).

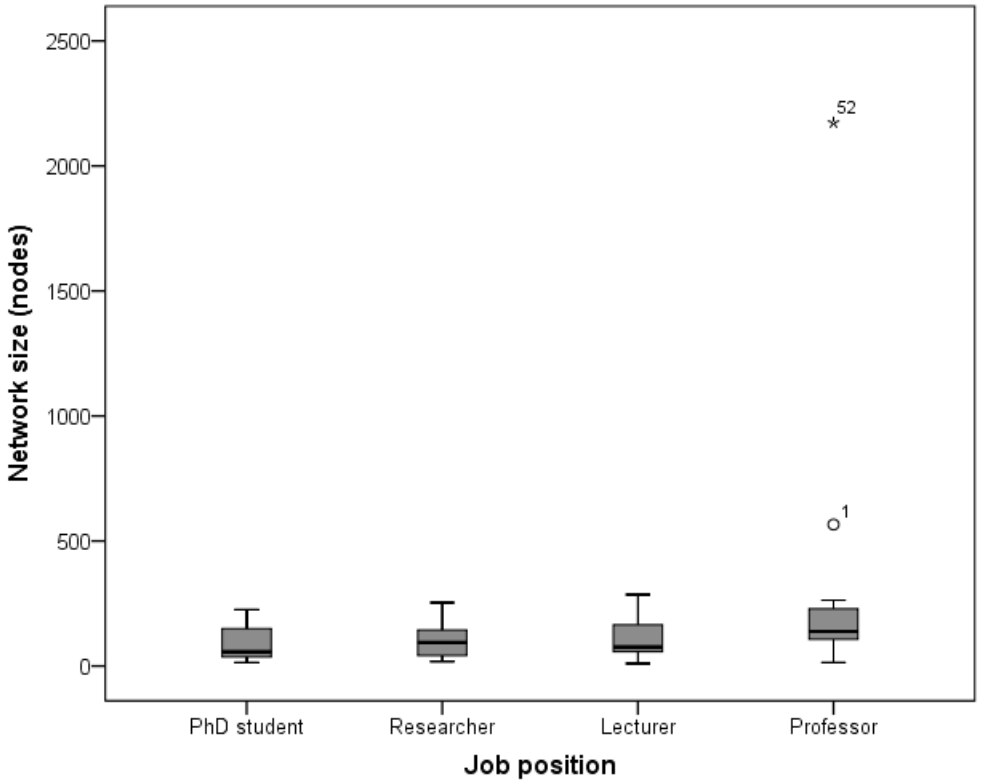


Figure 6.2.1.4: Distribution of network sizes in academic SNS networks according to job position.

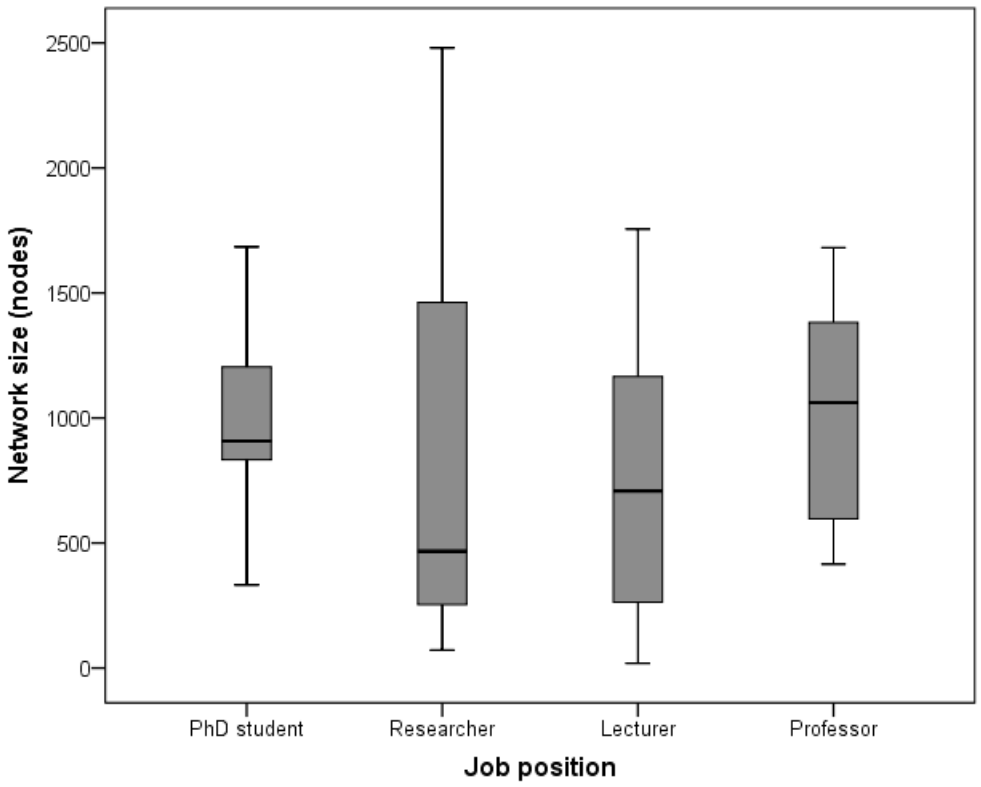


Figure 6.2.1.5: Distribution of network sizes in Twitter networks according to job position.

The distributions of in-degree and out-degree for the participants' academic SNS are shown in Figures 6.2.1.6 and 6.2.1.7 respectively; and distributions of in-degree and out-degree for the participants' Twitter networks are shown in Figures 6.2.1.8 and 6.2.1.9 respectively.

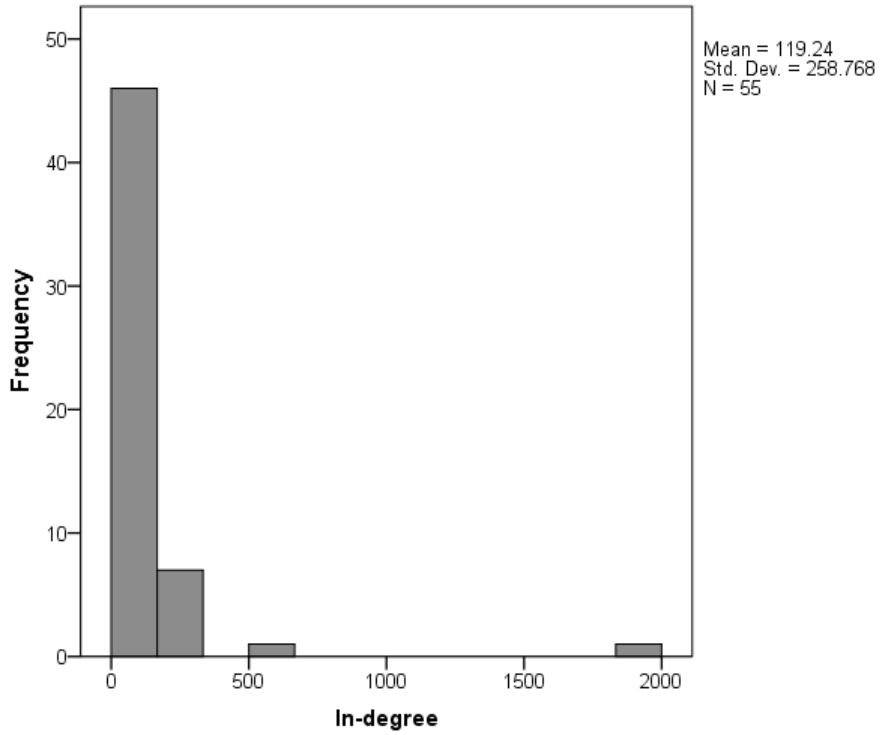


Figure 6.2.1.6: Distribution of in-degree for the 55 academic SNS participants.

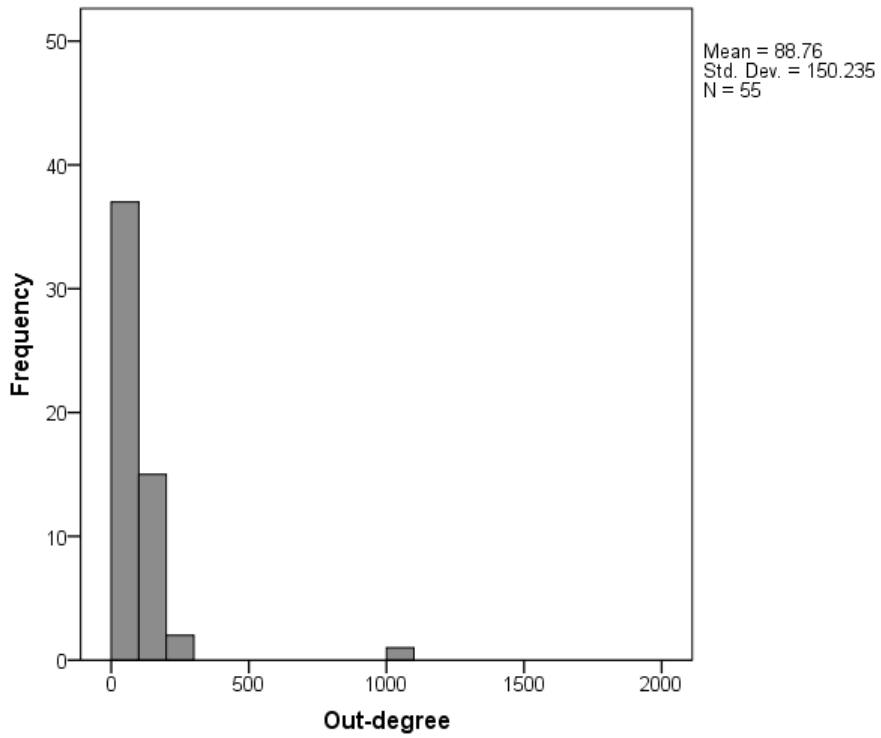


Figure 6.2.1.7: Distribution of out-degree for the 55 academic SNS participants.

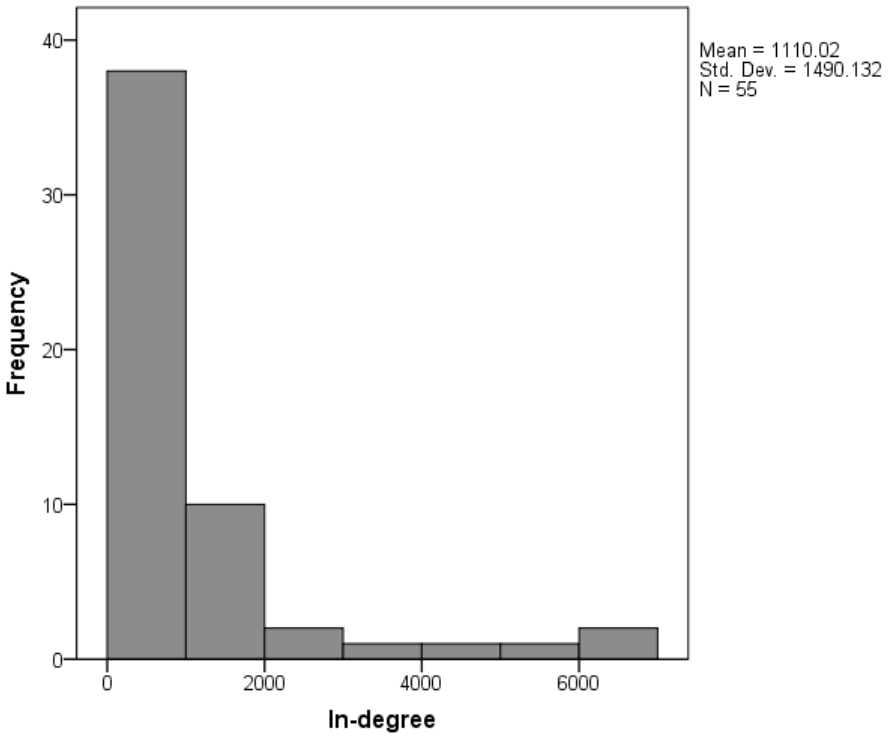


Figure 6.2.1.8: Distribution of in-degree for the 55 Twitter participants.

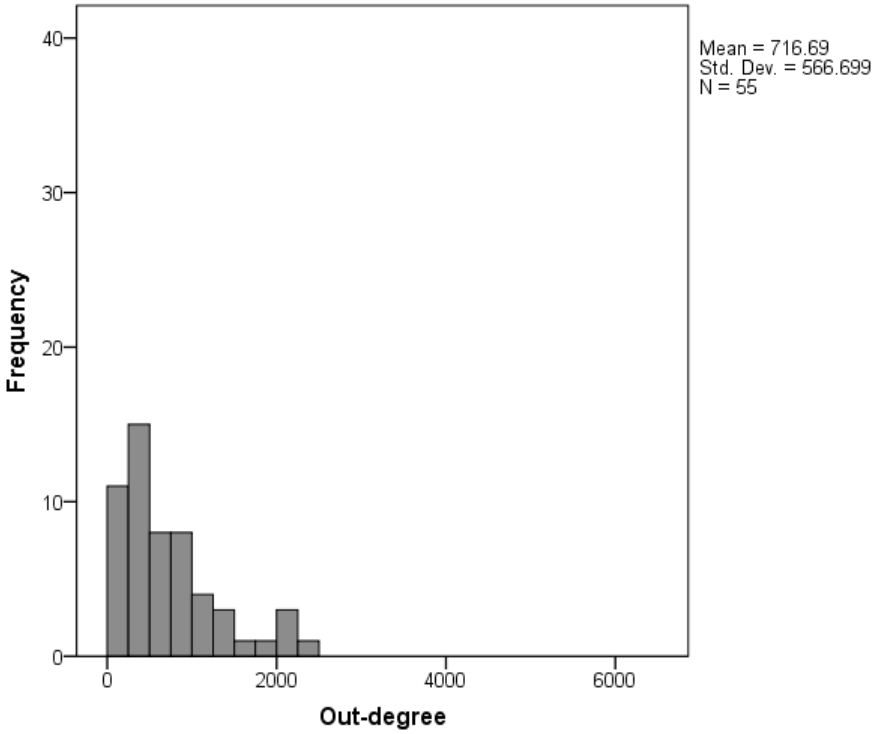


Figure 6.2.1.9: Distribution of out-degree for the 55 Twitter participants.

The histograms are in keeping with the characteristic steep drop-off and heavy tails often seen in SNA. For academic SNS, the median in-degree is 68 (interquartile range = 89.5) and median out-degree is 53 (interquartile range = 86); for Twitter, the median in-degree is 777 (interquartile range = 880) and median out-degree is 580 (interquartile range = 626).

In order to examine whether differences exist within the degree data according to job position or discipline, nonparametric statistical tests were applied. Note that the sizes of the sub-samples according to job and discipline are small, which decreases the likelihood of finding statistically significant differences. However, it is also useful to consider trends in the data. No significant differences were found on either platform according to discipline; and no significant differences were found in the Twitter networks in terms of job position. When considering differences according to job position, no significant differences were found in terms of degree and out-degree. However, an independent samples Kruskal-Wallis test revealed that the distribution of in-degree on academic SNS varied significantly according to job position, $\chi^2(3, N = 55) = 11.834$, $p = 0.008$, with Professors demonstrating the highest in-degree (Figure 6.2.1.10).

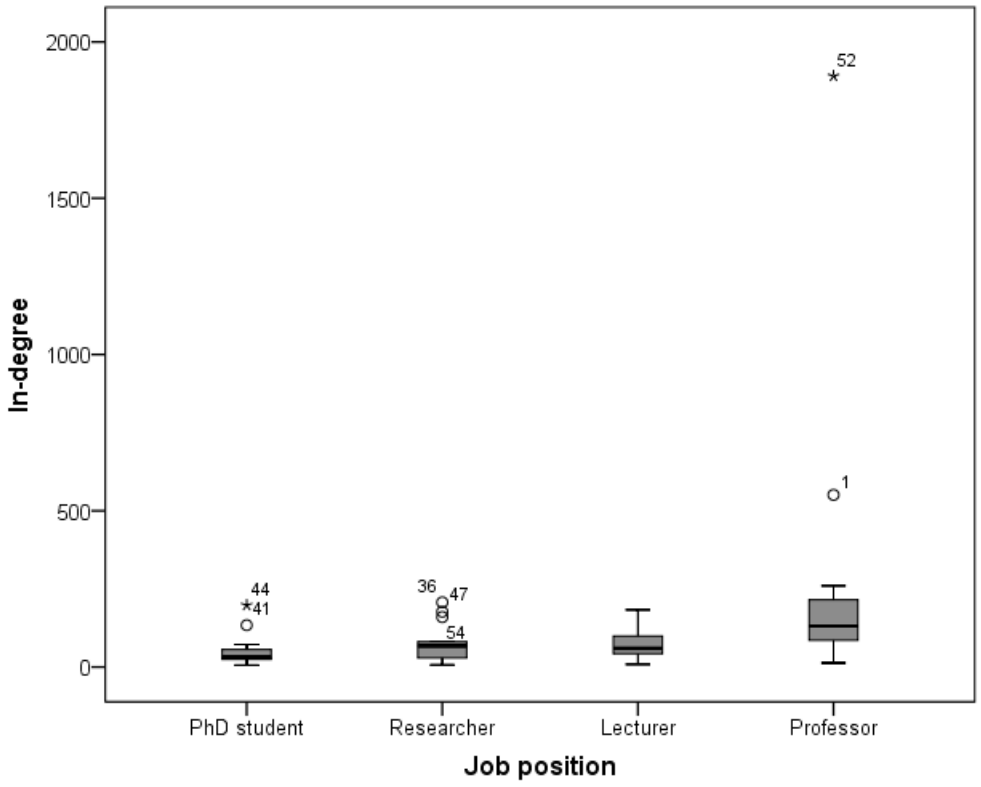


Figure 6.2.1.10: Distribution of in-degree according to job position for academic SNS personal networks.

Similarly, median values of in-degree varied significantly according to job position (independent samples median test. $\chi^2(3, N = 55) = 12.991$, median = 68.0, $p = 0.005$).

For comparison, the median in-degree and out-degree according to job category are shown for academic SNS in Figure 6.2.1.11, and for Twitter in Figure 6.2.1.12.

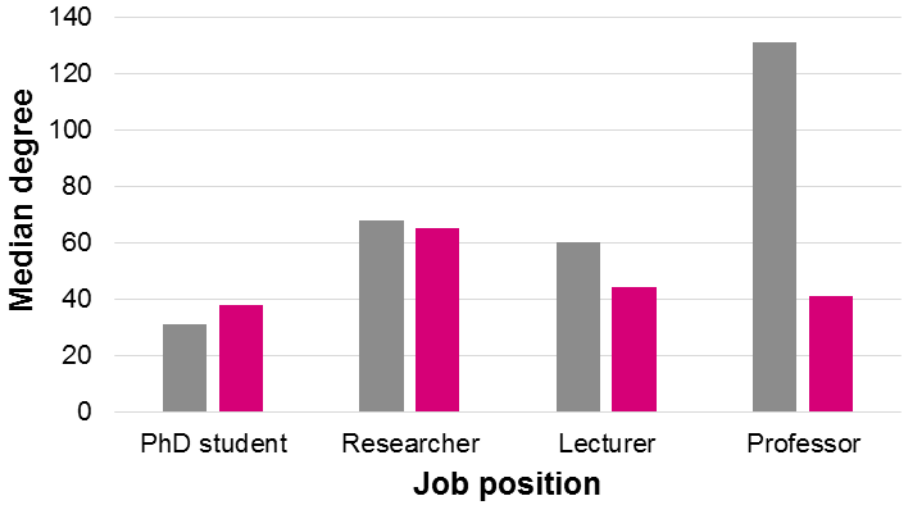


Figure 6.2.1.11: Median average in-degree (grey bars) and out-degree (pink bars) according to job position for academic SNS networks.

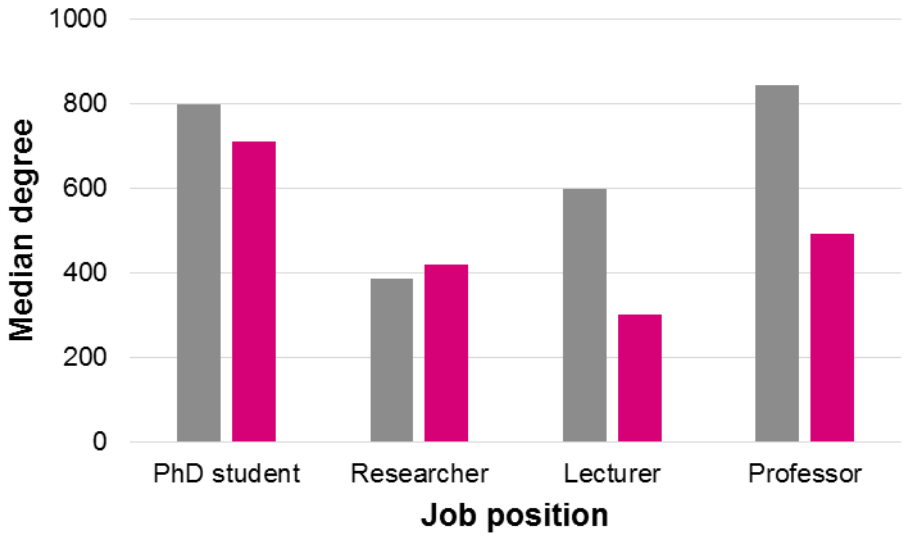


Figure 6.2.1.12: Median average in-degree (grey bars) and out-degree (pink bars) according to job position for Twitter networks.

A clear progression of increasing in-degree is seen in the context of academic SNS, with a large disparity between in-degree and out-degree for the most senior academics (professors). In the context of Twitter however, professors maintain the highest average in-degree although this is closely followed by graduate students; professors are also the group with the second highest out-degree, in contrast to academic SNS.

6.2.2 Communities

The number of communities within the networks was assessed by applying the modularity algorithm in Gephi (Blondel, Guillaume, Lambiotte & Lefebvre, 2008). The algorithm is a way of mathematically detecting communities, as defined by subgroups of highly-connected nodes within a network. Modularity, a scalar value between -1 and 1, is a measure of the quality of communities detected within a network, based upon the difference between the density of links within and between different communities. The modularity algorithm uses an iterative process to assign nodes to different communities in order to maximise the modularity (ibid.). The frequency of number of communities detected overall is shown for academic SNS in Figure 6.2.2.1, and for Twitter in Figure 6.2.2.2. Both follow an approximately normal distribution.

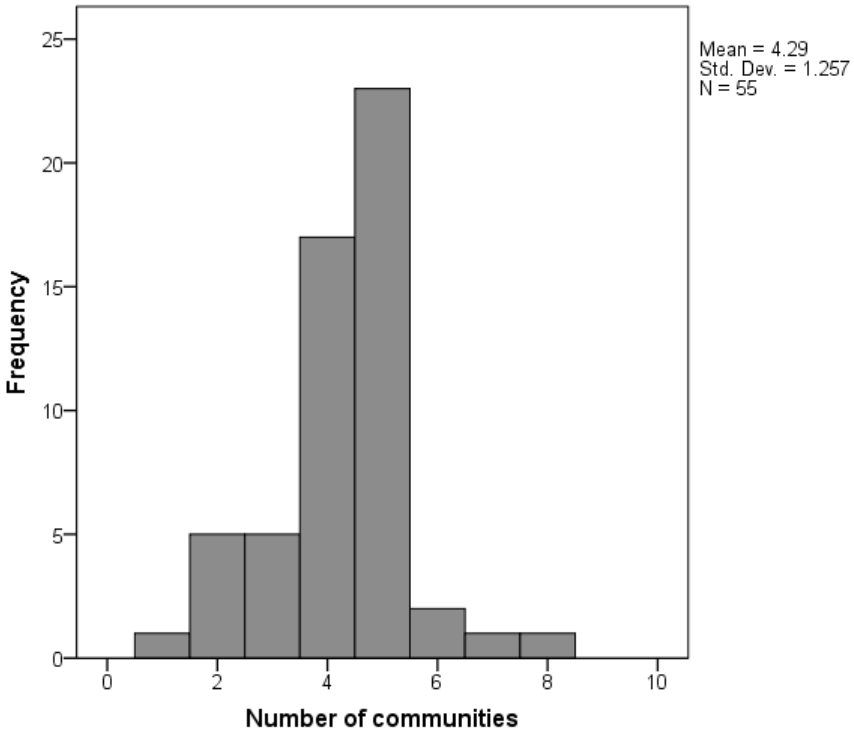


Figure 6.2.2.1: Distribution of the number of communities found in the academic SNS networks.

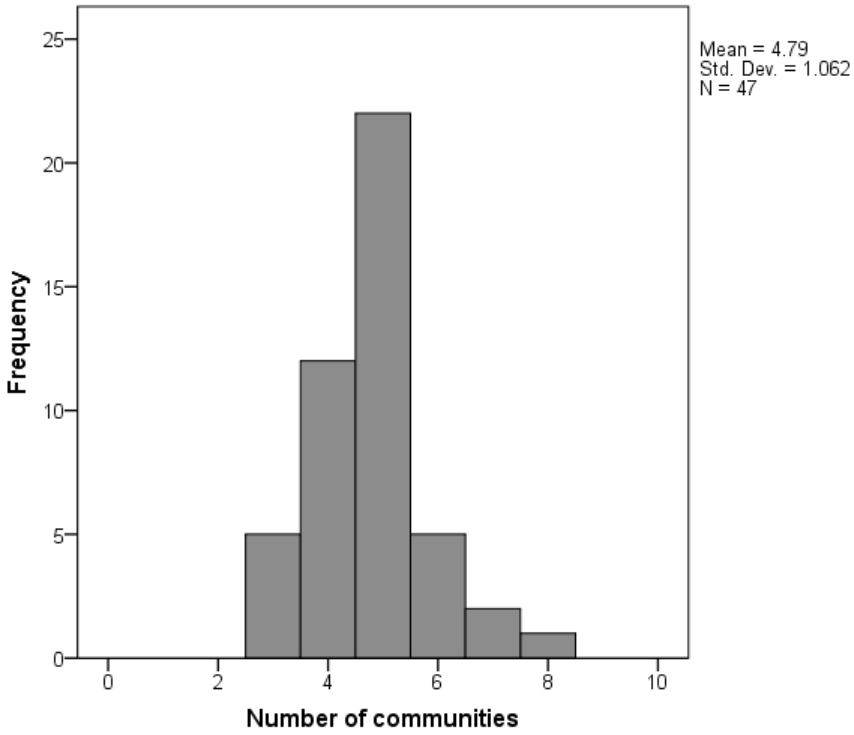


Figure 6.2.2.2: Distribution of the number of communities found in the Twitter networks.

Considering network size in terms of number of communities detected within the networks, Twitter networks comprise a greater number of average communities. Participants' Twitter networks exhibited significantly more communities than their academic SNS (paired t-test; there was a significant difference in number of communities in Academic SNS (M=4.28, SD=1.330) and Twitter (M=4.79, SD=1.062) personal networks; t(46) = -2.226, p=0.031). However, there is not a significant correlation between the two; so it does not follow that those with more communities on one platform, have more communities on the other. No significant differences in terms of job position or discipline were found for either platform.

6.3 Network structure

Two measures, network density and reciprocity, focus upon the network structure in terms of the links (edges) that exist between participants in the network as a whole. Betweenness centrality and brokerage measures examine the network structure in terms of communities within the network and the position of ego in relation to them.

6.3.1 Network density

Network density considers the structure of the whole network in terms of the number of connections that exist between nodes; that is, how many edges exist as a proportion of the total possible edges given the number of nodes in the network (Prell, 2012). It is a measure between zero and one; a network density of one would indicate that the network is complete and every possible combination of edges between every node exists, while a density of zero would indicate that there are no edges and the nodes are completely unconnected.

Examples of randomly generated graphs illustrating a range of network densities are shown in Figure 6.3.1.1.

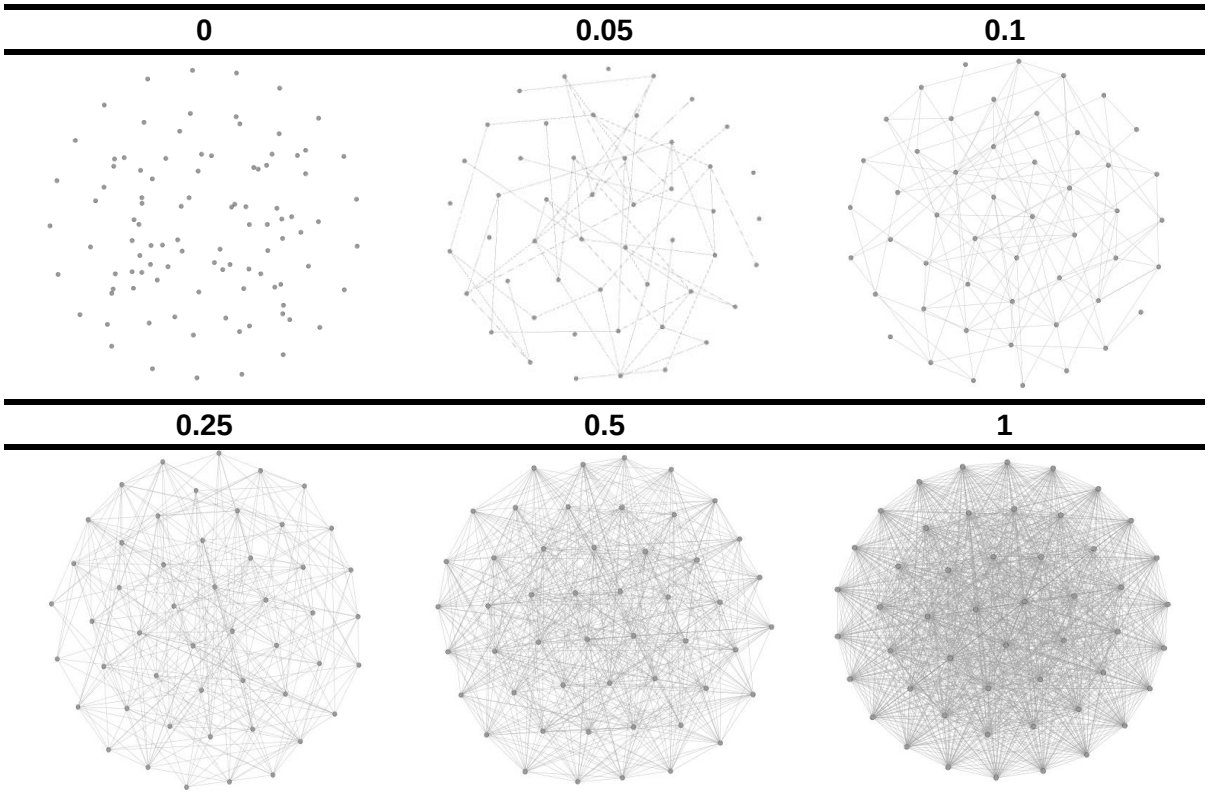


Figure 6.3.1.1: Examples of 50-node undirected random graphs generated using Gephi to illustrate a range of network densities from zero to one.

By looking at the density of an academic's ego-network, we can get a sense of the extent that the participants' connections are linked to one another and how close-knit their communities are. The frequency of network densities observed in the academic SNS and Twitter data are shown in Figures 6.3.1.2 and 6.3.1.3 respectively.

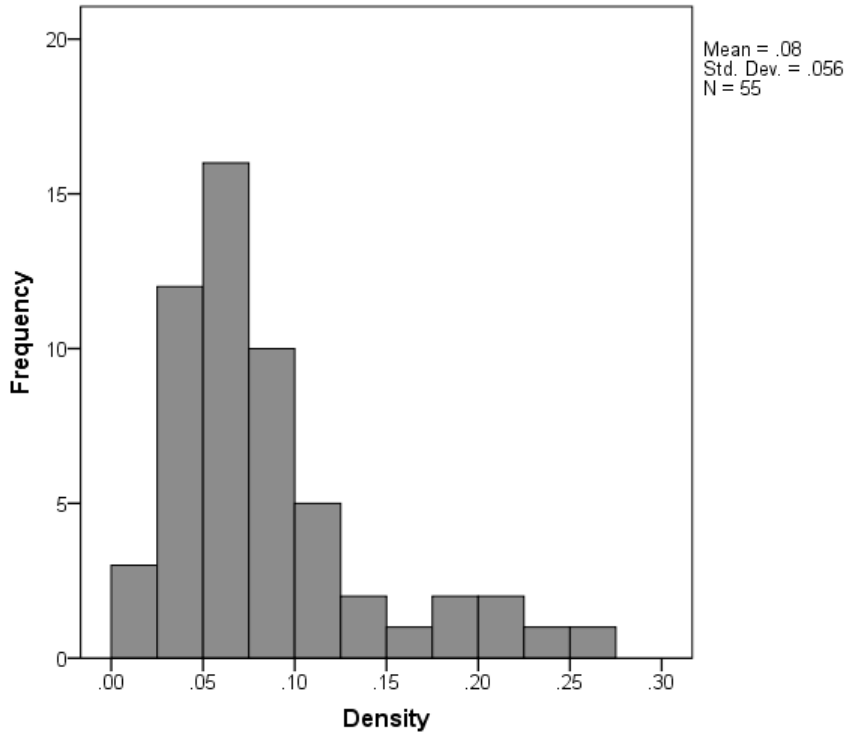


Figure 6.3.1.2: Network densities observed in the academic SNS networks.

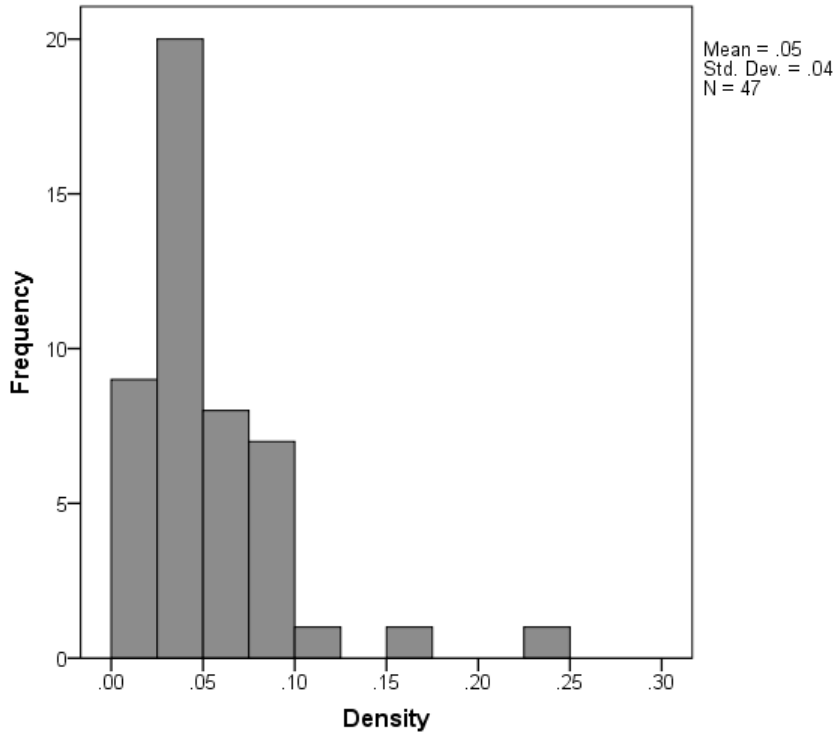


Figure 6.3.1.3: Network densities observed in the Twitter networks.

While both demonstrate a skew towards less dense networks, academic SNS are more dense (mean = 0.08, standard deviation = 0.06) than Twitter networks (mean = 0.05, standard deviation = 0.04). Participants personal networks on academic SNS are significantly more dense than their Twitter networks (paired t-test; there was a significant difference in network density in Academic SNS (M = 0.09, SD = 0.01) and Twitter (M = 0.05, SD = 0.01) personal networks; t(46) = -3.441, p = 0.001). No correlation was found between density of networks across both platforms, and no significant differences in density on either platform were found in relation to discipline or job position.

6.3.2 Reciprocity

As the relationships between nodes in the network graphs are directed, reciprocity is a measure of the extent to which pairs of nodes are both following each other (mutual) rather than existing only in one direction. This gives us an indication of how strong the participants' ties are with the people in their ego-networks. It is measured here by calculating the proportion of mutual ties in terms of the total number of pairs of connected nodes in the network (Hanneman & Riddle, 2005). As a proportion, values exist between zero and one; a reciprocity measure closer to one would indicate a high level of reciprocal ties within the network.

The distribution of reciprocity measures is shown in Figure 6.3.2.1 for the academic SNS, and in Figure 6.3.2.2 for the Twitter networks. Both demonstrate an approximately normal distribution.

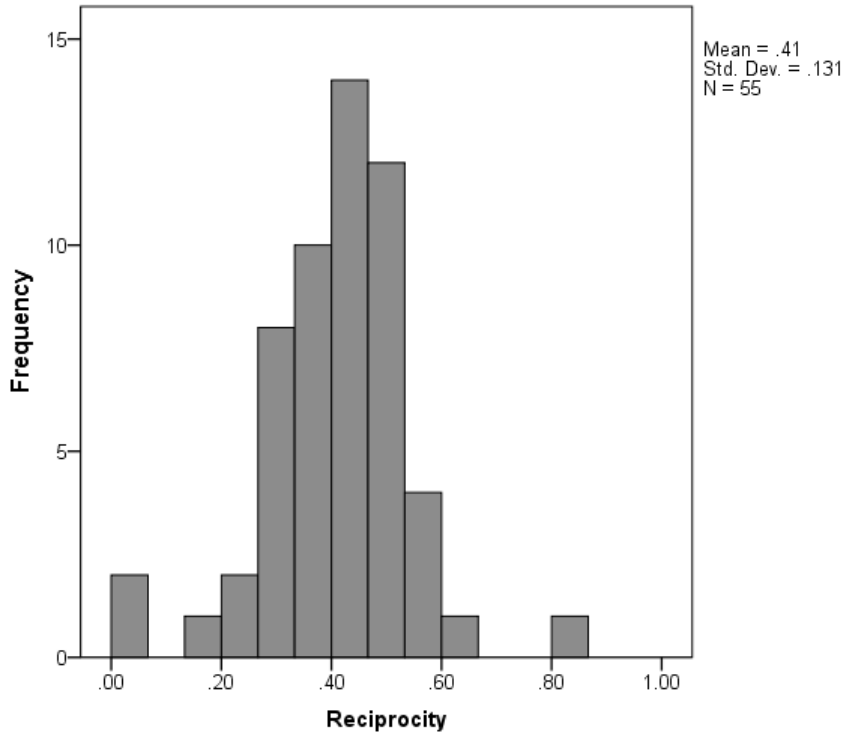


Figure 6.3.2.1: Reciprocity measures observed in the academic SNS networks.

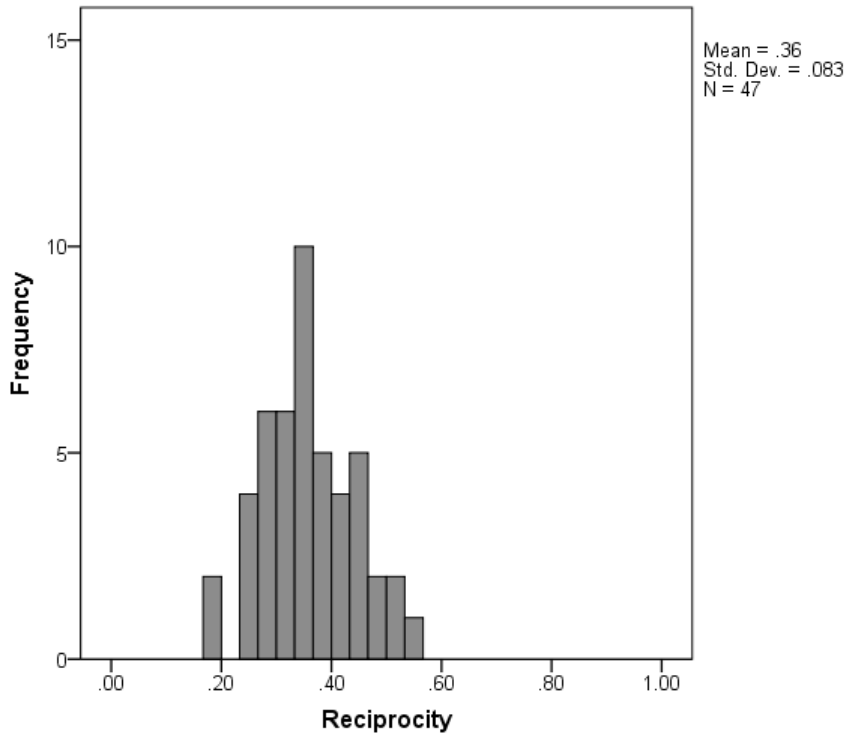


Figure 6.3.2.2: Reciprocity measures observed in the Twitter networks.

Academic SNS networks show a higher level of reciprocity on average than Twitter networks; the mean average reciprocity level observed in the Twitter data is 0.36 (standard deviation = 0.08), while the mean average reciprocity for academic SNS is 0.41 (standard deviation = 0.13). Reciprocity was significantly higher in academic SNS than Twitter networks (paired t-test; there was a significant difference in reciprocity in academic SNS (M = 0.41, SD = 0.02) and Twitter (M = 0.36, SD = 0.01) personal networks; t(46) = -2.269, p = 0.028).

There is variation in the reciprocity data according to both job position and discipline. Statistical tests showed significant differences with respect to discipline in the academic SNS data. In terms of comparing the distribution of reciprocity values per disciplinary category, independent samples Kruskal-Wallis tests revealed that reciprocity varied significantly according to discipline (χ^2(2, N = 55) = 8.049, p = 0.018). In terms of comparing the averages of reciprocity values, an independent samples median test showed significant differences according to discipline (independent samples median test. χ^2(2, N = 55) = 9.969, median = 0.41, p = 0.007), with the Arts and Humanities showing a higher degree of reciprocity compared to the other disciplines (Figure 6.3.2.3). No significant differences were found in reciprocity according to discipline in the Twitter networks. However, a similar trend is observed, with Arts and Humanities showing higher average reciprocity.

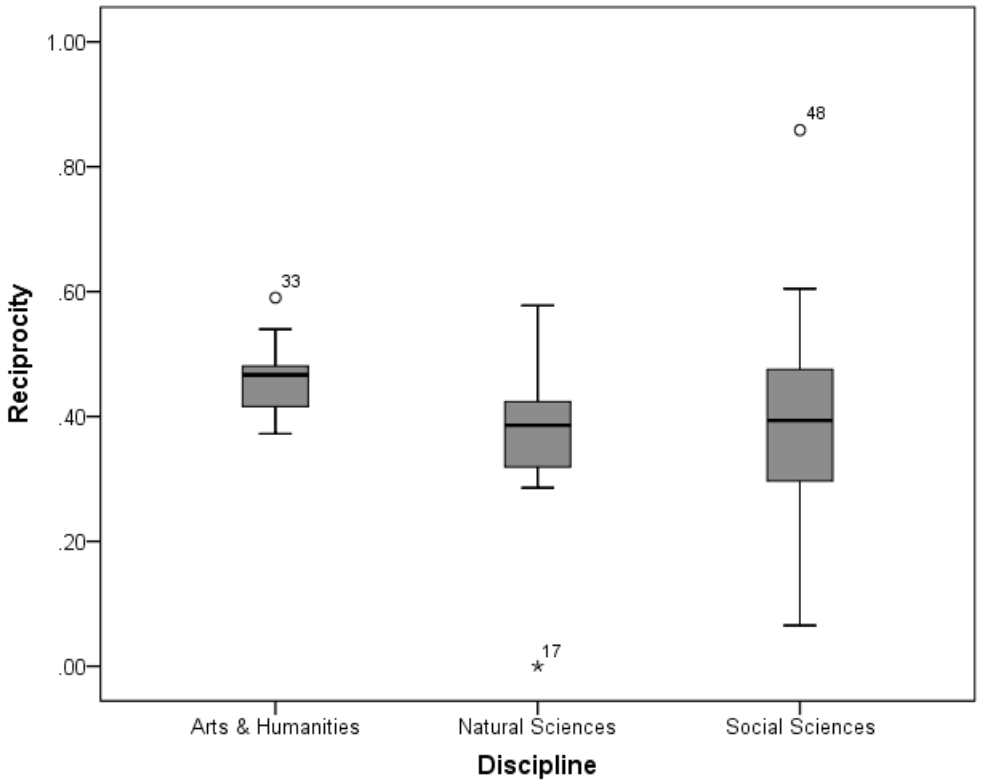


Figure 6.3.2.3: Reciprocity measures observed in the academic SNS networks according to discipline.

In contrast, significant differences according to job position were found in the Twitter data but not for academic SNS. For the Twitter data, an independent samples Kruskal-Wallis test showed significant differences in the level of reciprocity seen in the whole ego-network according to job position ($\chi^2(2, N = 55) = 8.087$, $p = 0.044$), with the networks surrounding graduate students showing a greater extent of reciprocity compared to the other job positions, and professors showing the lowest reciprocity in their networks on average (Figure 6.3.2.4). The ego-networks of professors also demonstrate the lowest average reciprocity on academic SNS while the ego-networks of graduate students, researchers and lecturers show similar levels of reciprocity, although the difference between groups was not found to be statistically significant. Note that reciprocity is measured here for the entire ego-network surrounding each participant, so reflects the level of

reciprocity in the community surrounding them, rather than the participant alone. However, the disparity between in-degree and out-degree seen according to job position (Section 6.2.1) would suggest that personal levels of reciprocity are reflected in a similar way.

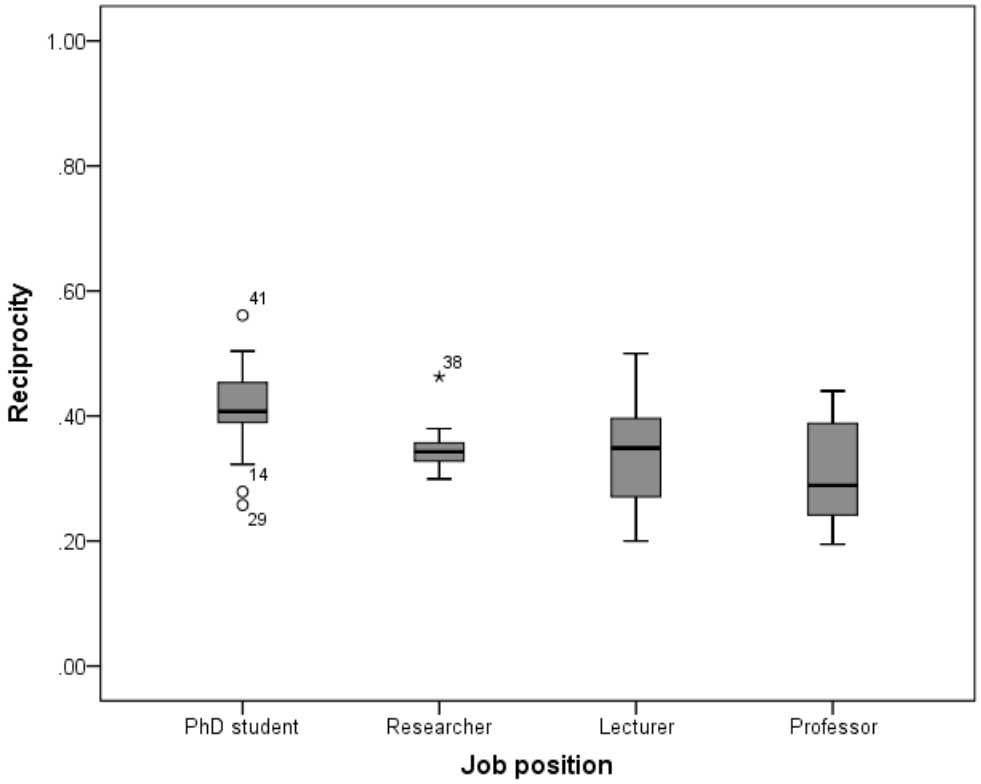


Figure 6.3.2.4: Reciprocity measures observed in the Twitter networks according to job position.

6.3.3 Betweenness centrality

Betweenness centrality is a measure based upon the number of shortest paths – that is, the most efficient ways of navigating between any two given nodes in the network – which can be used to approximate the extent of structural holes present in the network. Structural holes are notable gaps between communities in the network and can give insights into participants' social capital (Burt, 2005); betweenness centrality can be used as a proxy for this as the less connected that the constituent communities are, the greater the extent that ego will be relied upon

to find pathways between nodes (Prell, 2012). In the context of an ego-network, higher betweenness centrality for the ego node would therefore suggest that structural holes are present to a greater extent, and imply that ego is playing the role of a broker between them to a greater extent (Prell, 2012). Note that the measure of ego betweenness centrality has been normalised in order to be able to draw comparisons between participants.

To illustrate the relationship between ego betweenness centrality and brokerage, the participants' academic SNS networks which gave the highest and lowest values of ego betweenness centrality, and the effect upon the network of removing ego, are shown in Figure 6.3.3.1.

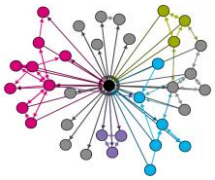
ID	Betweenness centrality	Network with ego	Network excluding ego
15	0		
46	0.72		

Figure 6.3.3.1: The academic SNS ego networks of participants with the highest and lowest ego betweenness centralities, showing the effect of removing ego from the network. Nodes are colour-coded to reflect communities.

The distribution of ego betweenness centralities for both academic SNS and Twitter are shown in Figures 6.3.3.2 and 6.3.3.3, respectively.

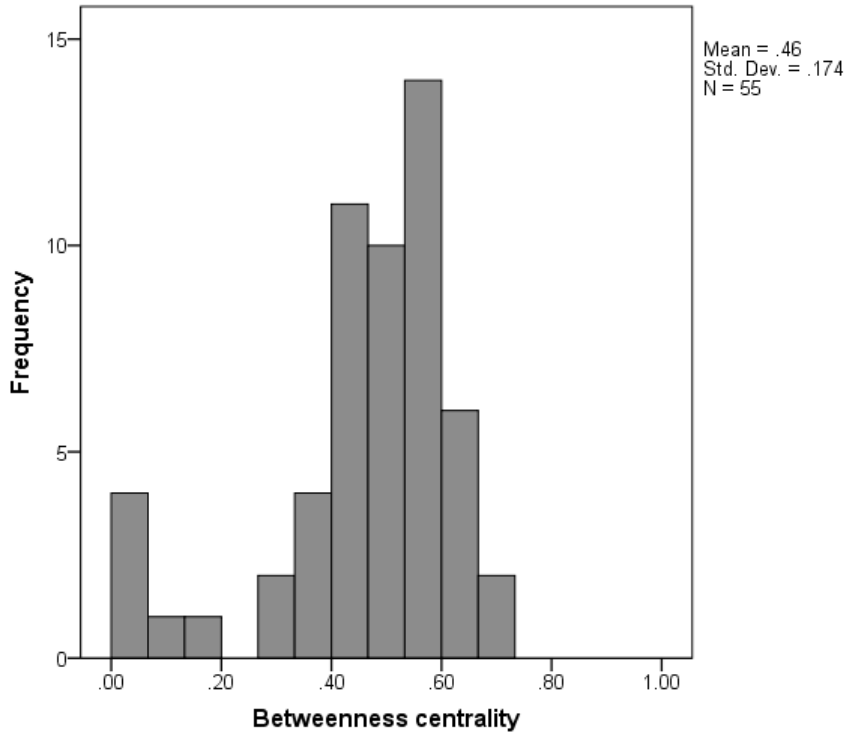


Figure 6.3.3.2: Betweenness centralities observed for ego in the academic SNS networks.

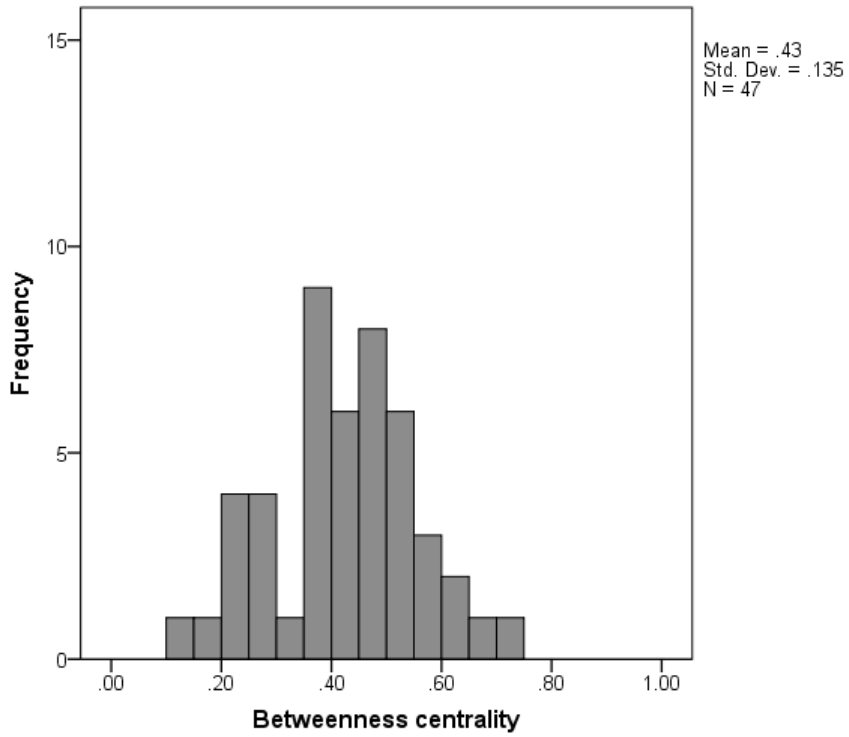


Figure 6.3.3.3: Betweenness centralities observed for ego in the Twitter networks.

Ego betweenness centrality has been normalised so values sit between zero and one (this was necessary for comparability, as the non-normalised figure is dependent upon network size); higher values indicating that the participant sits on a greater proportion of the shortest paths within their network. Academic SNS show a slightly higher average ego betweenness centrality and exhibit a wider range of values than Twitter (academic SNS mean average = 0.46, standard deviation = 0.17; Twitter mean average = 0.43, standard deviation = 0.14).

No statistically significant differences in ego betweenness centrality in terms of discipline or job position were found for either academic SNS or Twitter. Academic SNS data may indicate a trend toward decreasing ego betweenness centrality with seniority; although professors show the lowest average ego betweenness centrality and graduate students the highest, no statistically significant differences were detected (Figure 6.3.3.4).

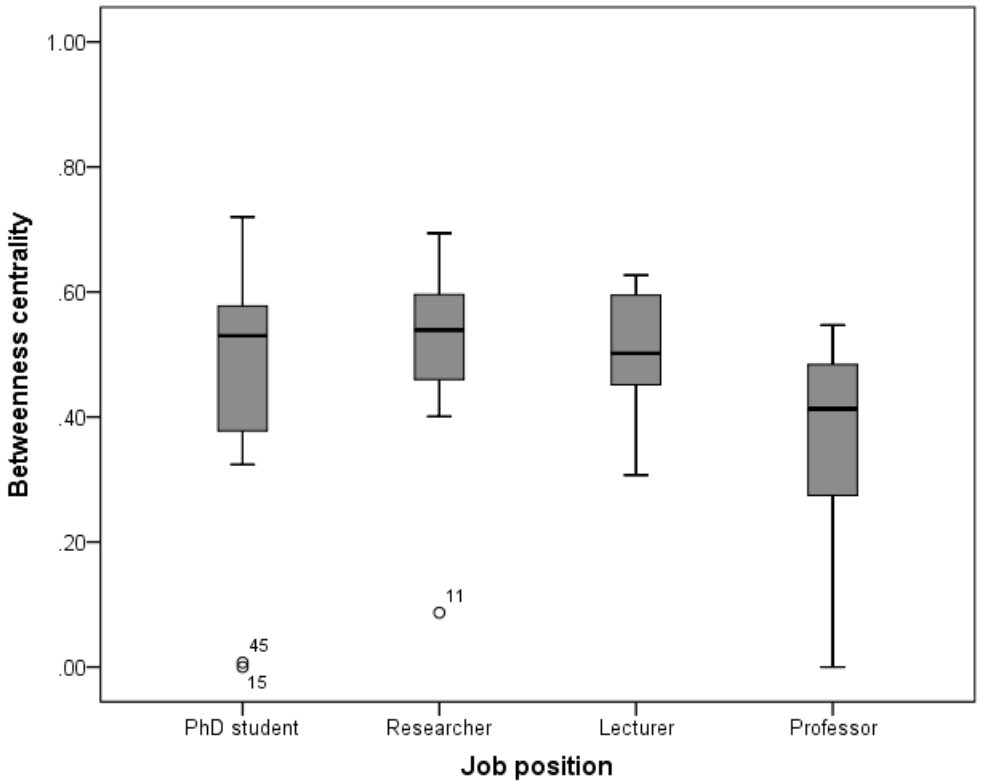


Figure 6.3.3.4: Ego betweenness centralities observed in the academic SNS networks according to job position.

6.3.4 Brokerage

Structural holes, and the way that ego acts as a broker between communities, can be further characterised by tests developed by Gould and Fernandez (Prell, 2012). Gould and Fernandez developed tests to examine how frequently nodes in a network assume different brokerage roles according to a typology of five roles (De Nooy, Mrvar & Batagelj, 2005; Prell, 2012), illustrated in Figure 6.3.4.1.

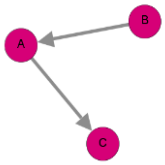
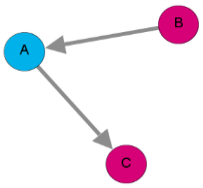
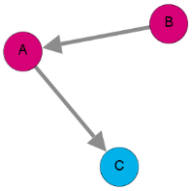
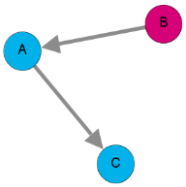
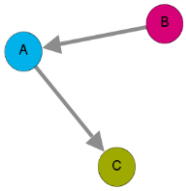
Coordinator	Itinerant broker	Representative	Gatekeeper	Liaison
				
Broker is part of a community and mediates between other members of the same community	Broker mediates between members of the same community without being a member herself.	Broker mediates flow of information out of a community.	Broker mediates flow of information into a community.	Broker mediates between two different groups, neither of which she belongs to.

Figure 6.3.4.1: Types of brokerage roles identified by Gould and Fernandez. Node 'A' is the broker in each; nodes are colour-coded according to membership of different communities. After Everton (2012), De Nooy, Mrvar and Batagelj (2005), and Prell (2012).

Assuming that ego is the connection between two other nodes, the typology relates how ego modulates the flow of information between communities, by considering the possible combinations of community membership possible for the three nodes.

The tests are "a classification of the forms of brokerage relations that is an exhaustive listing of the possible types of two-step paths on which any actor may lie" (Bellotti, 2009); that is, by considering every triad that the node is part of in the network, the score is a count of how frequently each type occurs. Gould and Fernandez brokerage tests were carried out using Pajek (Everton, 2012). As the data produced is a count, the actual figures will vary according to the size and structure of each network. Comparisons will therefore be drawn based on the modal category of each participant rather than the absolute values.

Scores for the five brokerage types on academic SNS and Twitter are shown for all participants in Appendix G, with the modal brokerage type for each participant

being shown in bold. For academic SNS, the most frequently observed modal types were representatives (n = 22) and liaisons (n = 20). No instances of participants as primarily itinerant brokers were found. Twitter networks were dominated by liaison type brokers (n = 31); no instances of coordinator or itinerant brokers were found. Bar charts showing the frequency of primary brokerage roles on academic SNS and Twitter are shown in Figure 6.3.4.2.

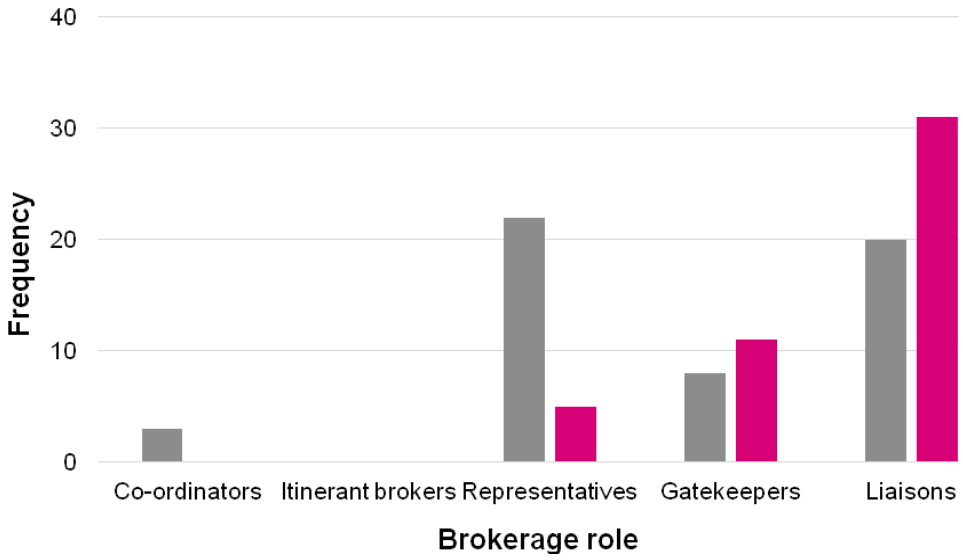


Figure 6.3.4.2: Frequency of brokerage types observed in the networks. Grey bars represent academic SNS, and pink bars represent Twitter.

While there is some variation in frequency of roles in academic SNS according to job and discipline, Chi-square tests did not detect statistically significant differences in frequency of roles according to discipline or job position (full charts for both platforms broken down by job and discipline are shown in Appendix G).

6.4 Summary

The analyses described in this chapter primarily help elucidate the network structure of academics' ego-networks on academic SNS and Twitter. Differences in network structure may reflect different social dynamics on contrasting platforms, and have implications for the types of interaction and flow of information that can be facilitated (Chapter 3). The results are summarised here in relation to the RQs.

6.4.1 What are the structural characteristics of academics' online ego-networks on social networking sites?

Structural characteristics of academics' ego-networks on academic SNS have been examined here in two principal ways: in terms of metrics related to network size, and network structure. These basic measures can indicate how wide a pool of people ego can draw upon, and how widely information can be transmitted (Prell, 2012).

An overview of the metrics is shown in Table 6.4.1.1.

Table 6.4.1.1: Overview of metrics for the SNA tests undertaken on the Twitter and academic SNS personal networks.

Metrics			Twitter	Academic SNS
Network size	Number of nodes	Median	894	91
		IQR	936	122
	Degree	Median	1293	119
		IQR	1623	168
	In-degree	Median	777	68
		IQR	880	90
	Out-degree	Median	580	53
		IQR	626	86
	Communities	Mean	4.79	4.29
		SD	1.06	1.26
Network structure	Network density	Mean	0.05	0.08
		SD	0.04	0.06
	Reciprocity	Mean	0.36	0.41
		SD	0.08	0.13
	Ego betweenness centrality	Mean	0.43	0.46
		SD	0.14	0.17
	Brokerage	Modal type	Liaisons	Representatives

While the size of the networks involved shows a good deal of variation, there are structural features which are common across the dataset and social networks more broadly. Networks on both platforms show degree distributions which are steeply unequal with fat tails; that is, a large proportion of academics have relatively few connections, while a small proportion exhibit very high degree. This is a classic characteristic of social networks more generally (Barabasi, 2011). However, the number of people in the participants' ego-networks spans a wide range of values, and average network size is considerably larger on Twitter compared to academic SNS. Overall, participants have a higher average in-degree

than out-degree (i.e. they have more ‘followers’ than they are ‘following’), although there is variation in the data according to job position (see Section 6.4.3).

In keeping with social networks more generally, clusters of highly inter-connected nodes – communities – are seen within the network graphs on both platform, the median number of communities within each network being four. Understanding the nature of the communities and their relationship with the participants will also be addressed in part by interpretation with participants via interviews in Chapter 7.

Network densities are relatively low; for Twitter, the network density translates into 5% of all possible ties existing, while it is slightly higher at 8% for academic SNS. Reciprocity is approximately 36% for Twitter and 40% for academic SNS, although there is significant variation according to job position and discipline (Section 6.4.3).

Higher average ego betweenness centrality suggests more structural holes exist in the academic SNS (0.46) compared to Twitter (0.43). The platforms show a clear contrast in terms of the types of brokerage roles academics play. For academic SNS, the modal brokerage type is ‘representatives’, a role which places academics in an outward-facing role mediating flow of information from a group. In contrast, ego most frequently plays a ‘liaison’ type brokerage role (that is, linking groups while not being closely affiliated with either) observed in Twitter networks.

In conclusion, the structural characteristics of academics’ ego-networks differ according to platforms. Twitter networks are larger, less dense, with lower reciprocity and fewer structural holes. The most frequent brokerage role is that of ‘liaisons’; academics act as a link between various communities while not being strongly affiliated with either. In contrast, academic SNS networks are smaller, more dense, with higher reciprocity and more structural holes. The main brokerage

role seen is the ‘representative’, mediating flow of information out of a community. Together these metrics would suggest that Twitter networks are more open and academic SNS networks are more highly defined by existing academic groups and structures, which will have implications for the flow of information around the different networks.

6.4.2 How do academics construct and understand their ego-networks?

RQ2 was not addressed by the network analyses. However, the resulting network graphs and trends identified in network structure went on to form the basis of co-interpretive interviews designed to gain insight into networks from the viewpoints of participants specifically to address this question. Results from these research activities are reported in Chapter 7.

6.4.3 Does the structure and/or role of the network differ in nature according to academic career trajectories?

The data shows that some aspects of network size and structure exhibit differences according to discipline or job position. While few differences were statistically significant, trends were observed in some of the metrics. The results of the statistical tests undertaken are summarised in Table 6.4.3.1.

Table 6.4.3.1: Overview of statistical evidence for differences according to discipline for the SNA tests undertaken on the Twitter and academic SNS personal networks.

		Discipline		Job position	
		Academic SNS	**Twitter**	**Academic SNS**	**Twitter**
Network size	Number of nodes	No	No	No	No
	Degree	No	No	No	No
	In-degree	No	No	**Yes**	No
	Out-degree	No	No	No	No
	Communities	No	No	No	No
Network structure	Network density	No	No	No	No
	Reciprocity	**Yes**	No	No	**Yes**
	Ego betweenness centrality	No	No	No	No
	Brokerage	No	No	No	No

Network size exhibits different trends on different platforms according to job position. On Twitter, graduate students and professors have larger average networks than researchers or lecturers, with higher degree and out-degree. In the academic SNS data, professors have the highest degree, despite having the lowest out-degree, due to having a greater number of followers. In-degree shows significant differences according to job position, increasing with seniority.

In relation to network structure, significant differences were found in terms of both discipline and job position for reciprocity. On academic SNS, significant differences in reciprocity were found according to discipline, with Arts and Humanities exhibiting higher levels of reciprocity. This trend was also seen in the Twitter data, although the differences were not statistically significant. On the other hand, the Twitter data did show significant differences in reciprocity according to job position, with graduate students showing the highest levels of reciprocity and professors the lowest. The trend is also reflected in the academic SNS, to an

extent; professors show lower levels of reciprocity than the other categories, although the difference is not statistically significant.

The findings reinforce the results in Section 6.4.1, in that academic SNS preserve academic hierarchies to a greater extent than Twitter. It is striking that while the academic SNS networks reflect academic hierarchy, in the context of Twitter, graduate students and professors show the greatest similarity (Figures 6.2.1.11 and 6.2.1.12).

7. Results: Interviews and Case Studies

The previous two chapters have discussed the results of the survey and network analyses (Chapters 5 and 6). This chapter will focus upon the interview data, which provided an opportunity to explore the trends in survey and network analysis data from the perspective of the participants themselves.

A total of 18 interviews were held; the main purposes of the interviews were to annotate the network structures and understand the processes involved in the networks' creation, from the viewpoint of the academics involved. This primarily addressed RQ2, although the annotation of networks to understand the nature of communities also contributed to RQ1, and all data contributed to RQ3. Data here is drawn from all parts of the study, and presented as rich case studies.

For brevity, 12 of the case studies are presented in this chapter (one per job and discipline combination as sampled); the other six case studies can be found in Appendix I. In instances of job-discipline combinations for which there were multiple participants, the participant whose survey responses reflected the overall trends to a greater extent were selected for inclusion in this chapter.

In order to protect the identities of the participants, institutions are referred to using letters ('University A', for example). The letters correspond to annotation of network diagrams and are consistent within each case study, but do not refer to the same institutions across case studies ('University A' for Alice is not the same as Carol's 'University A', for example). The job positions and subject areas are based on the categories the participants selected in the survey. The results will be

summarised at the end of this chapter, and cross-case analysis and themes drawn from all 18 case studies will be discussed in detail in Chapter 8.

7.1 Alice

When she completed the survey, Alice was a lecturer in Biological Sciences and Biochemistry at 'University A'. At the time of the interview, she had recently started a research-focused position in the same field at 'University B'.

Alice does not consider herself to be an accomplished user of social media in her professional life at the moment (in response to the item '*I feel I should probably do more to promote my research using online networks*', she remarked that "I am lame at it"). She most frequently visits Facebook and Google Scholar, and uses ResearchGate and Twitter on a weekly basis. Although she has never written a blog, she does read the blogs of others.

Throughout her survey responses, Alice emphasised that she views Facebook as "private" and not involved in her professional life, although the distinction is blurred in some cases, as she is also connected via Facebook to several former colleagues who she considers friends. As a result, Facebook can occasionally be of professional use, such as being able to ask questions of the online community. However, Alice doesn't view certain professional topics as appropriate for Facebook; for example, while Alice agreed with the statement '*social networking sites are a good way of promoting my own academic publications*' she remarked that it was "Only Researchgate/Twitter (Facebook is private- I don't think you should publicise your papers/grants/successes/failures on here)".

Alice uses ResearchGate as her academic SNS. Her ego-network on the site, Figure 7.1.1, is smaller (in terms of outward connections) and more dense than the average in the sample (her out-degree and number of communities are within the lower quartile of the data, while she is in the upper quartile for network density).

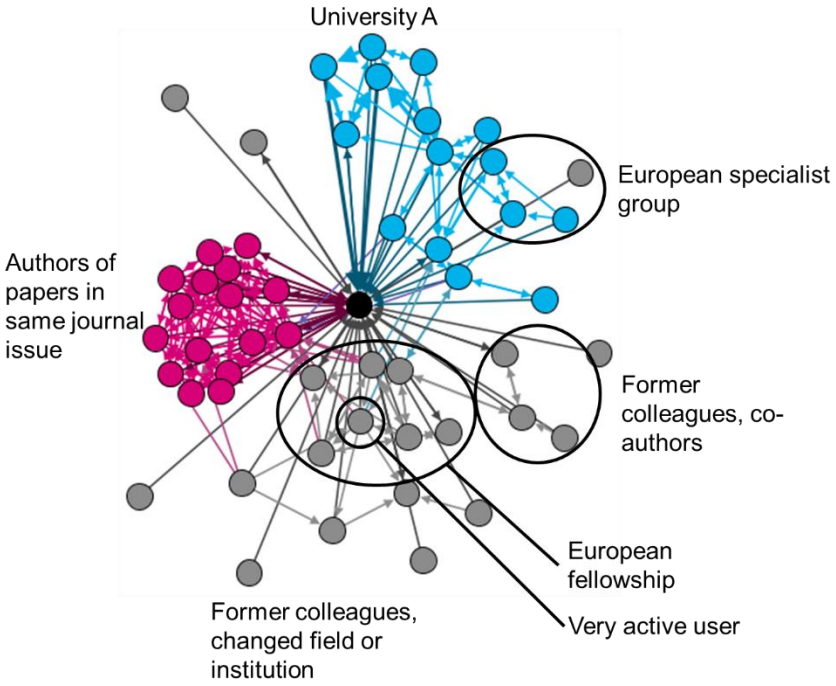


Figure 7.1.1: Alice's ResearchGate ego-network.

She has mixed feeling about her use of ResearchGate at present; she occasionally answers questions, but is less willing to supply information such as papers which are readily available online. "I don't really like it, sometimes I've looked through the questions that people ask, and sometimes they just annoy me. If I've got an easy answer I'll just post it or put a link to something, so I have engaged with it a bit. It annoys me when people request full PDFs of things when you can access them online and stuff like that."

While the network structure of the pink community would suggest a close, highly-connected community, this is not the case. Alice explained that the members of

this community were all authors on papers in a certain issue of a particular journal. By virtue of automated connections on ResearchGate, and a quirk of the journal (citations feature everyone in the issue rather than single papers), this community has been created but Alice does not have a working relationship with its members "On ResearchGate I get updates from these authors … but I have no idea who they are or no link except the same journal".

The dense part of the grey community relates to a research fellowship Alice undertook at a European university; the community is highly specialised and combines face-to-face working relationships and co-authorship. The blue community relates to University A, including colleagues and PhD students that they co-supervise. The reciprocal links which are not linked to the communities include former colleagues who have moved to other institutions or changed fields. Alice does not frequently see them at conferences, but this provides a way of staying connected to an extent. One node was identified as being particularly active online. Alice is aware of who she is from conferences, but appears to consider this as a different type of relationship; "she just seems to follow everyone on everything, like she's on Facebook and follows me and comments on everything but I don't *know* her, it's just one of them." (Alice's emphasis). Alice agrees with the suggestion that the network structure here is a reflection of people she has worked with in the past, rather than those she would like to work with in the future, and reinforcing existing relationships.

Alice's Twitter ego-network, Figure 7.1.2, is the smallest in the network sample, in terms of total nodes, in-degree and out-degree. She is in the lower quartile in terms of number of communities. However, her network demonstrates relatively high density and reciprocity, being in the upper quartile for both metrics.

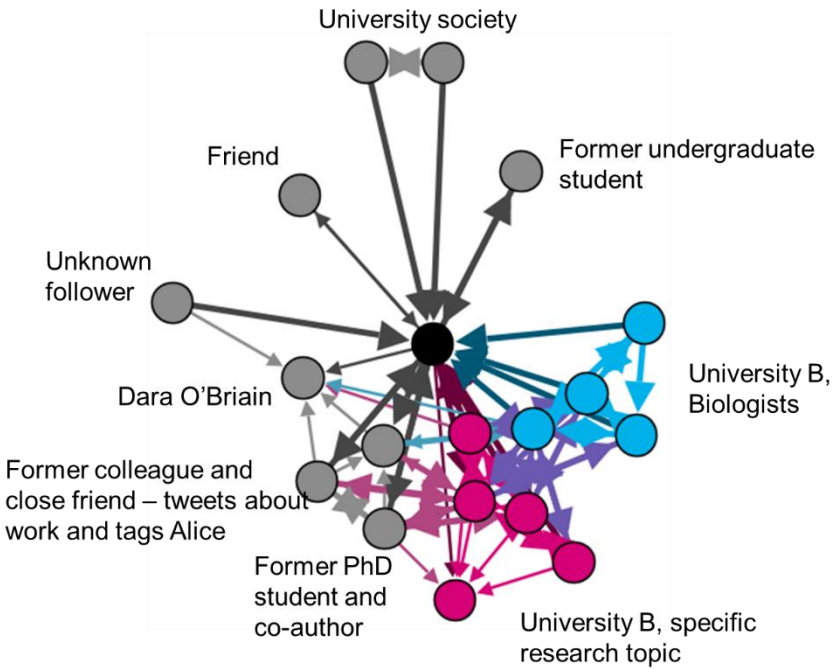


Figure 7.1.2: Alice's Twitter ego-network.

She has been growing her network through involvement with a society related to her research interests at University A. The society has developed a small community on Twitter and via a recent event, she has developed more links with this community, expanding the small but close knit community of academics in her Twitter network. Alice feels she is still learning how best to use the platform: "I just need to figure out how to use Twitter really, 'cos I honestly didn't know! […] It's not very hard, but I just haven't explored it". She does see benefits of using it, but is yet to integrate it into her academic practice: "I do think it is a useful way to follow

new publications and people – I just need to make it part of my routine, and I haven't".

7.2 Carol

Carol is a researcher in Education at 'University C'. She studied Philosophy as an undergraduate at 'University A' and moved to 'University B' for postgraduate study. She does not view her move into Educational Research as a formal switch from Humanities to Social Sciences, but rather sees her interdisciplinary role as an opportunity for synergy between the disciplines. Carol has profiles on a range of social media platforms; on most days, she will use Facebook, Twitter and blogs. Less frequently, she also uses Academia.edu, Google+, Google Scholar, LinkedIn, Mendeley and Slideshare.

Carol's Academia.edu network, Figure 7.2.1, reflects her academic background in Philosophy.

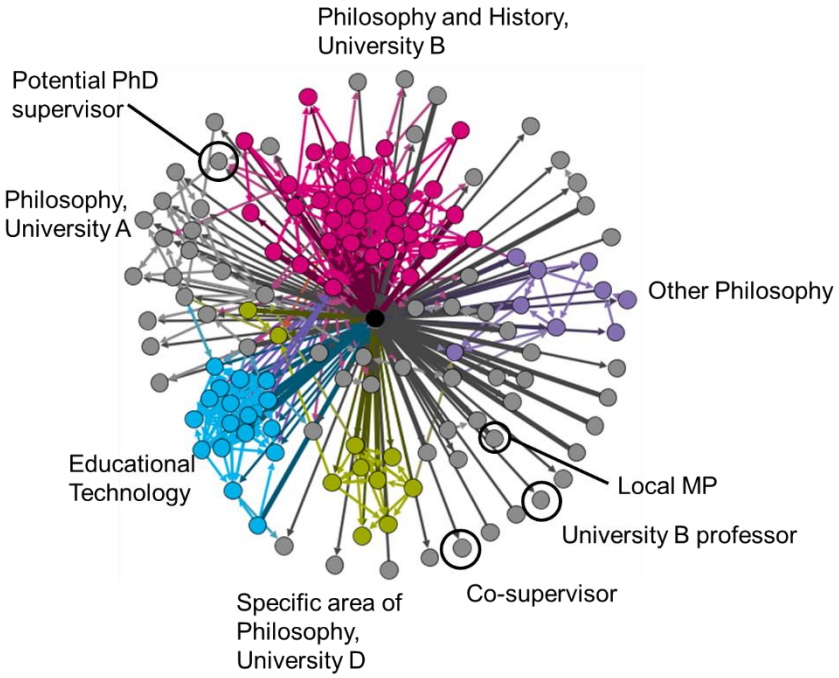


Figure 7.2.1: Carol's Academia.edu ego-network.

She finished her PhD in 2012, and began using Academia.edu as a doctoral student; she cites examples of book reviews as content which she posted before gaining her doctorate. “Part of my academic identity remains as Philosophy, in a sense that I still participate in conferences, I still publish in that area but it’s done outside of […] the role that I have now.” Carol views her move from Philosophy to Education not as a change of discipline but as an opportunity to foster interdisciplinary approaches and this is a niche which Carol is currently exploring. Her Academia.edu network reflects this interdisciplinary approach to an extent; she may be more willing to seek out connections, being in the upper quartile in terms of out-degree.

Her network also demonstrates a high ego betweenness centrality (upper quartile), which suggests that Carol is acting as a broker between communities which would otherwise be more weakly connected. The network is both highly clustered around particular communities (clustering coefficient in upper quartile), and of a low density overall (lower quartile).

Carol's current role is reflected in the blue community, which comprises academics in Educational Technology, both at University C and internationally. The majority of other communities are related to Philosophy, although they are notably distinct and defined by institutions. The pink community represents Philosophers and Historians at University B; Carol also highlights a professor who you would expect to be part of this community but is not well connected (the professor does not appear to actively use the account). The grey community is also related to Philosophy, mainly from University A. Carol highlights a key connection between the grey and pink communities as someone who would have been a potential supervisor when she was looking into PhDs; he connects both communities but is

at neither institution. The green community represents Philosophy academics at 'University D', which Carol has no formal affiliation with; the group at University D specialise in her research interests within Philosophy. Carol spoke at their conference a couple of years ago, and was on the committee for organizing this year's conference. The grey, unconnected nodes are a "bit of a mash-up" – Carol highlights one connection in a different department of University C, who she co-supervises a student with. She agrees that she already knows most of the people in her Academia.edu network.

Carol's Twitter network, Figure 7.2.2, is very large.

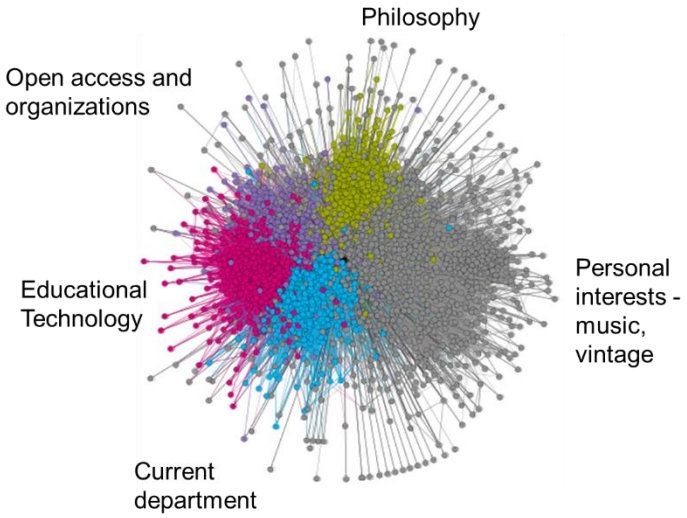


Figure 7.2.2: Carol's Twitter ego-network.

'Following' 2001 people, she is at the upper limit of what can be collected with NodeXL; her total number of nodes, in-degree and out-degree all fall within the upper quartile of the data. As with her Academia.edu network, her betweenness centrality in relative high (being in the upper quartile), and her ego network has a relatively low density (lower quartile). Carol found identifying communities challenging in her Twitter network, due to size, overlap and that Twitter IDs often do not carry real names. The blue community is primarily academics from Carol's

current department. Educational Technology more broadly is represented by the pink community, with links to the lilac community, which is primarily concerned with open access, publications and organisations. Philosophy is represented by the green community, with no distinction according to institution. The grey nodes reflect a range of diverse personal interests; for example, a cluster within the grey community is related to vintage-related interests and music.

Carol uses Twitter more actively than Academia.edu, and she finds that the site fosters new connections more readily. Although Carol created her Twitter account before becoming a postdoctoral researcher, the ethos of open practices have fostered her increased used of the platform. Having seen the benefits of the professional use of Twitter, Carol would view it as an essential part of any future professional activities or different jobs. However, Twitter isn't able to serve all the requirements of an online academic presence; "Twitter can't act as a repository or showcase my academic record in the same way that something like Academia.edu can, and some people use Academia.edu to go and look at what kind of publications someone has got or they're searching for a particular thing and come across your profile, I don't think people would find you in the same way or know what you'd done in that respect by using Twitter."

7.3 Gillian

When she completed the survey, Gillian was working as a researcher in Biological Sciences and Biochemistry at 'University B'. She has since moved to a different academic role, which is not research focused. She completed her degrees and a postdoctoral position in Biological Sciences topics at 'University A'. She pursued a second postdoctoral research position at 'University B' and now holds a joint

appointment between two universities ('University B' and 'University C'). Gillian's preferred social networking platforms are Facebook and LinkedIn, visiting the sites on a daily basis. She typically uses Google+, ResearchGate and Twitter weekly, and uses Google Scholar and Mendeley on a monthly basis. She has profiles at Academia.edu, a blog and a Slideshare account, but rarely uses them.

Gillian's ResearchGate network, Figure 7.3.1, was one of the smallest in the sample, being in the lower quartile in terms of nodes, in-degree, out-degree and number of communities, while in the upper quartile in terms of network density, reciprocity and clustering.

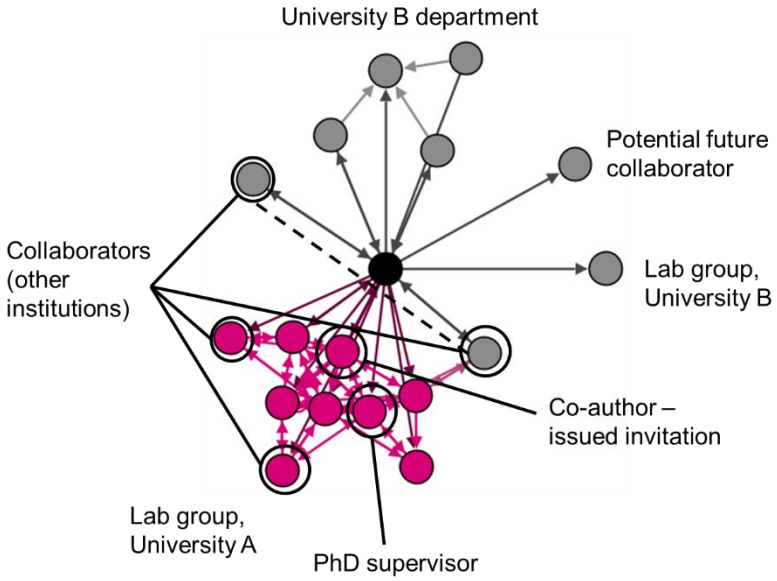


Figure 7.3.1: Gillian's ego-network on the ResearchGate platform.

Gillian has been using the site for around two years, but "[hasn't] spent an awful lot of time on it", mainly using it to connect with people she has already authored papers with so far. She joined whilst working as a postdoctoral researcher, being encouraged to do so by the university "as a way of building up our academic networks", and prompted by receiving an email invitation from an existing co-author. Uploading new publications is the main reason for Gillian to update her

profile, to enhance the visibility of her work and herself, although she prefers to use Google Scholar to keep track of the impact of her work in terms of citation counts.

Gillian personally knows most of the people in her ResearchGate network; “I try not to add people who I don’t know personally, or to networks generally, although Twitter is a bit of an exception to that. My LinkedIn and Facebook, I know all the people on them, ResearchGate not quite so much because I might not have met all the collaborators, but I am connected to them through papers.” She identified an unconnected node who she had contacted (online, via email) as a potential future collaborator whilst in her research post, “but I ran out of time to write grants”. She hopes to be able to make use of this connection in the future.

Gillian started using Twitter in 2011, when she joined University B. “I guess it kind of seemed like the thing to do, all the popular kids were doing it [laughs] […] I may have been on a public engagement training course, that encouraged us to think about using other forms of social media to engage with the public. I started fairly slowly, didn’t use it much for a long time, and then it just sort of spiked around [a conference] 2012, and then it’s just been growing slowly ever since, and then I started getting interesting information through it and I started using it more, so I’m getting links to conferences, links to funding, links to jobs, and the people who I’m following were posting interesting content, so that just motivates you to do the same and post things that you think would be interesting for other people”.

Her Twitter network, Figure 7.3.2, does not exhibit any extremes in terms of network metrics.

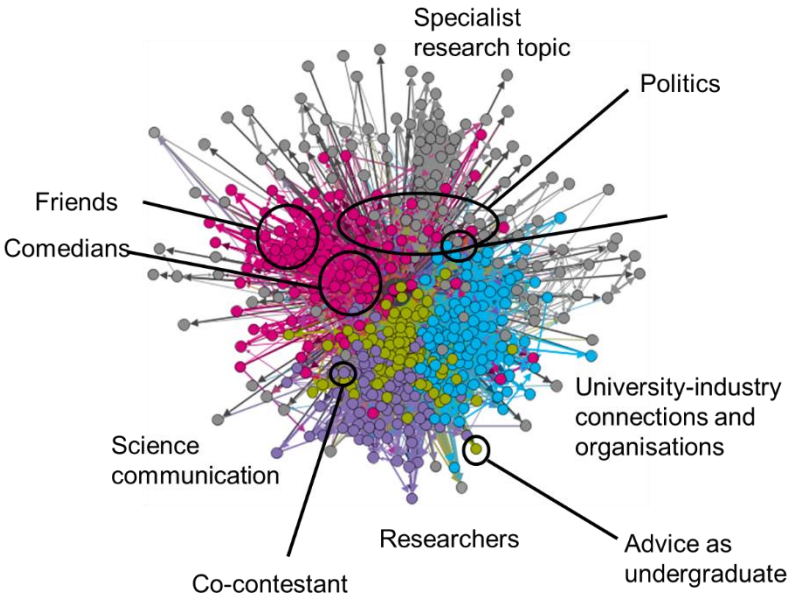


Figure 7.3.2: Gillian's ego-network on Twitter.

The communities reflect a combination of research topics and personal interests. Gillian also has a Facebook profile, "that tends to be my actual friends – people who I have met through uni, met through societies, a few people who I've met through work and I would be comfortable sharing personal updates with, but it tends to be much more personal."

Although she has been developing her Twitter network for several years, it more accurately reflects her current role than her previous research posts, "as it is all about engaging with the public, picking up different academic societies, different people doing public engagement research, developments in teaching, all that sort of stuff." When working in Biological Sciences, she perceived Twitter use to be more prevalent in ECRs. Having recently moved into a broader Natural Sciences

field, she notes that “the academics that I’m working with at the moment are a lot more active on Twitter than I’ve seen before, so I’m actually quite surprised.”

The move to her current role has also led to setting up multiple novel accounts related to the role. “I’m now actually in charge of the [doctoral training centre]’s Twitter, as well as potentially setting one up for [another project related to current post], because they don’t actually have a social media profile, so I’m trying to work out the best way of doing it, because I’m going to have to report to [research council] with regards to the [doctoral training centre] […] so I’m actually moving to the kind of role where I’m managing this kind of stuff and trying to make it bigger, in a logical way not just randomly adding people, it’s a bit of a challenge [laughs].” She also runs Facebook pages related to both, and notes that “what works on Facebook doesn’t necessarily work on Twitter”, and is also considering Instagram and YouTube.

7.4 Isaac

Isaac is a Philosophy PhD student, currently based at ‘University A’, studying as part of a joint programme with an overseas university (‘University B’) located in ‘Country X’. As an undergraduate, he studied at a different university (‘University C’) in Country X. Isaac most frequently uses Facebook and Twitter, which he visits on most days. He uses Academia.edu on a monthly basis. He rarely uses (visiting less than once a month) a blog, Google+ and LinkedIn. He primarily views his use of social media as personal rather than professional.

Isaac started using Academia.edu when he was an undergraduate student at University C. He signed up to the site for two main reasons: personal interest in being online (“just in general I like to be across what’s happening on particular

parts of the Internet"), and as he was looking towards a future academic, as a place "to subscribe to academics and eventually put my own stuff up there." Although he is a PhD student, his Academia.edu network is not in the lower quartile in terms of network size, so it is not one of the smallest. His network is in the upper quartile in terms of ego betweenness centrality, which suggests the presence of structural holes, and that Isaac may be situated as a broker between communities.

The two largest communities within his network, Figure 7.4.1, relate directly to institutional connections at University A (blue community) and University B (pink).

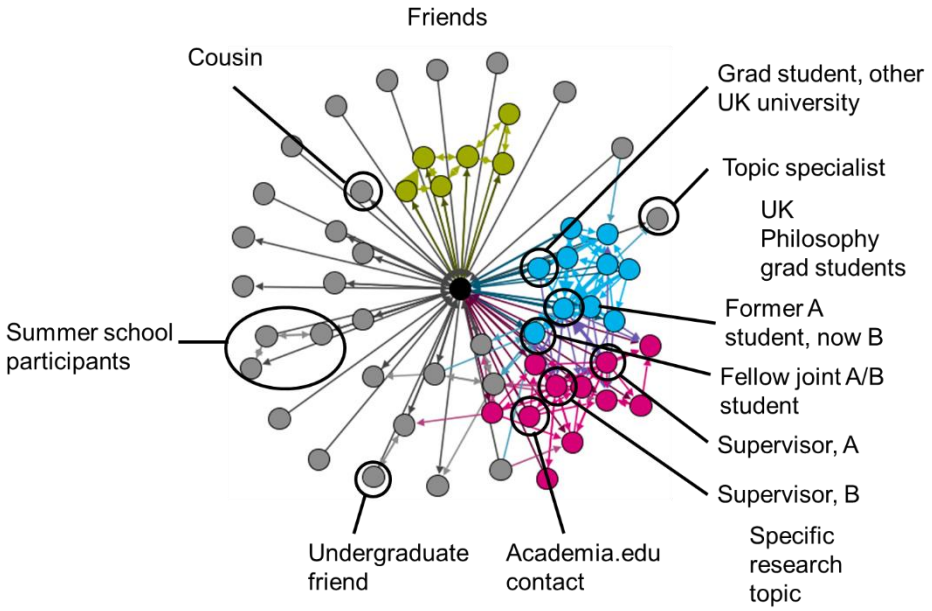


Figure 7.4.1: Isaac's ego-network on the Academia.edu platform.

The two communities are joined, reflecting the student exchange programme between the two institutions. Several of the grey, unconnected nodes, and the green community, are people who Isaac would primarily consider to be friends. He has used the 'login via Facebook' button in Academia.edu, which automatically imported any Facebook contacts who happen to use the site. Although he knows

most of the people in his network, he highlights a particular member of the pink community with whom a connection was facilitated by the site, on the recommendation of his supervisor who had met the new contact at a conference.

Isaac notes that although social media has great potential to help with the geographically-dispersed Higher Education sector in Country X, more activity and fostering of novel connections happens in the UK, as academics are able to attend events in person, and this helps build the online network; “I guess its interesting that that offline phenomenon manifests itself here, because you might think that because we [in Country X] don’t have as many opportunities for interaction at conferences, we might take it online, but actually it doesn’t quite work out that way.”

Isaac started using Twitter in 2009, for primarily personal reasons, initially making connections with members of his family. Although he now uses it professionally to an extent, he still views it as being mainly personal; “it remains a way of having a personal connection to those I know professionally”.

Isaac's Twitter network, Figure 7.4.2, shows relatively high reciprocity (upper quartile), and low density.

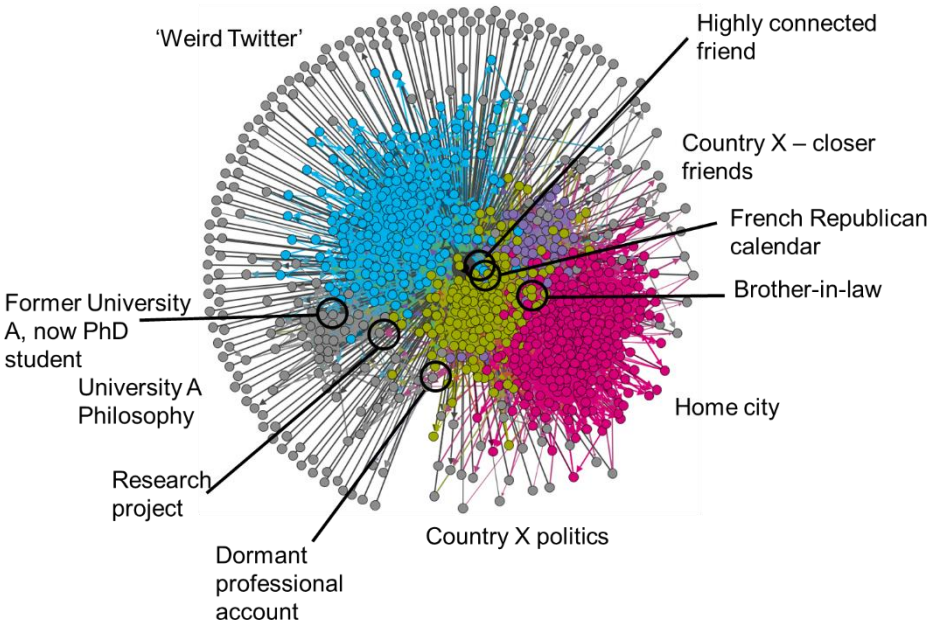


Figure 7.4.2: Isaac's Twitter ego-network.

The communities within his network primarily reflect keeping connected with his home in Country X, and personal interests. Isaac describes the blue community as being a distinct online group, "A community called Weird Twitter, which was around a few years ago. […] It was quite a disparate group of people who were telling jokes there, and also people who were interested in poetry and I don't know, sort of techno-mysticism, people who were graduate students in politics, people who were graduate students in Philosophy".

Isaac's network also includes a small community related to Philosophy at University A. Connections to others in his subject area are an exception to his mainly personal-focused use of Twitter, "in the sense that I now have personal relationships with people who are in Philosophy, I guess". However, he doesn't often tweet about his work; "Sometimes I do tweet about doing the work […] as a

way of talking about what it's like to study a Philosophy PhD, that sort of personal narrative stuff that's common, but no, I won't sort of enter into philosophical debates." If Isaac published a new paper, he would upload it to Academia.edu but not tweet about it; "I'm conscious of the fact that a lot of these people wouldn't be interested in it".

Isaac mentioned people in the pink and green communities who are also in his Academia.edu network – interesting that they are not all in one community here. He finds an example of someone who is likely to be linked to all his Twitter communities; "in my mind she's equally linked to all four of these". Browsing the network, Isaac remarks that "I keep on coming across a few of my own accounts!". Isaac estimates that he has around a dozen accounts. Examples include projects, parody accounts, and various others, but his main account is the only one he uses every day.

7.5 Jacob

Jacob is a PhD student in Politics at 'University A'. He is now approaching the end of his PhD, and has recently started a teaching post in the same department whilst writing up. He also studied as an undergraduate at the same institution. His doctoral studentship also included a Masters year at University A, and he undertook teaching activities during his doctoral studies. He plans to pursue a career in academia. Jacob's most frequently used SNS are Twitter and Zotero, which he uses on most days. Less frequently, he uses Academia.edu, a blog and Google Scholar. He has profiles at Google+ and LinkedIn, but doesn't use them.

Jacob started using Academia.edu during his Masters year, as a conscious attempt to develop and raise his online profile as an academic. Jacob believes in

the importance of open knowledge and open access to research, and began his Academia.edu profile in this spirit. At the same time, he also began to develop his institutional web page to use as a repository for his work, which initially comprised MRes course essays and conference presentations. While his institution has an online repository, students are not freely able to add to it. He has continued to host publications on both his Academia.edu page and institutional web page.

The density of Jacob's Academia.edu network, Figure 7.5.1, is relatively low, being in the lower quartile for the metric.

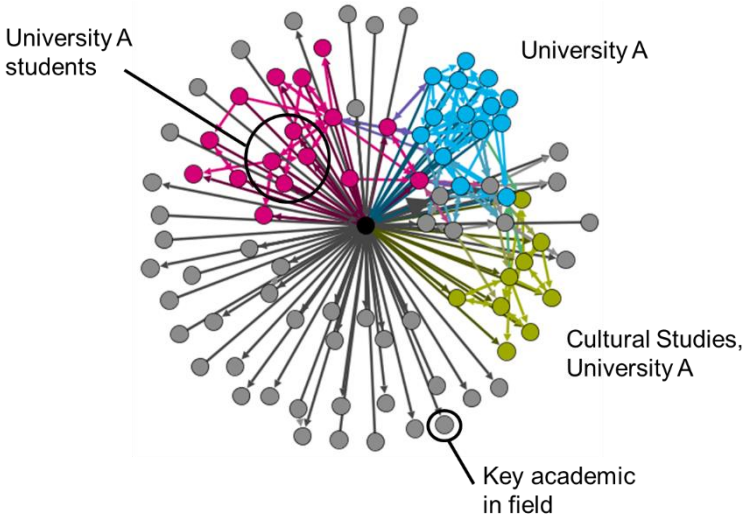


Figure 7.5.1: Jacob's ego-network on the Academia.edu platform.

Visually, a substantial proportion of Jacob's connections are peripheral and unconnected to each other – "these are mostly people who I don't know, and I just fancied following" – but Jacob highlights one academic who is "really key to my field". The communities identified within Jacob's Academia.edu network are not clear-cut; "I don't recognise any structure here at all". The communities which are present all relate to University A in some way. Jacob agrees with the idea of an Academia.edu profile being akin to a business card, and attributes the network structure to this. "It's a bit of a mish mash […] but that probably reflects the way I

use Academia. I don't use it to keep track of networks, all the people I just follow willy-nilly, I really don't use Academia very often at all […] I don't really pay attention to these people or follow what they put on their pages."

Academia.edu as a platform has not lived up to Jacob's hopes; the community that he had hoped would be fostered has not materialised. "It doesn't feel full of hope for me anymore. It feels like the kind of website that's probably going to end up kind of more like MySpace or Bebo for academics, nobody really uses it. […] That was a website that I went in to feeling quite hopeful, but, having used it, it's not been a great experience and certainly not been a very active network. I wonder if that's because it's only academics and academics are sort of boring online, and you really need some vim and vigour in your online dealings." Despite this, Jacob still updates his profile; he thinks it would be better to have no profile at all, rather than a poorly maintained one.

Jacob's use of Twitter began before his PhD, while working in youth engagement as a research assistant and press officer; "if you're in that kind of industry, you can't get around using Twitter". His network, Figure 7.5.2, is in the lower quartile for density (the second lowest in the sample), and reciprocity.

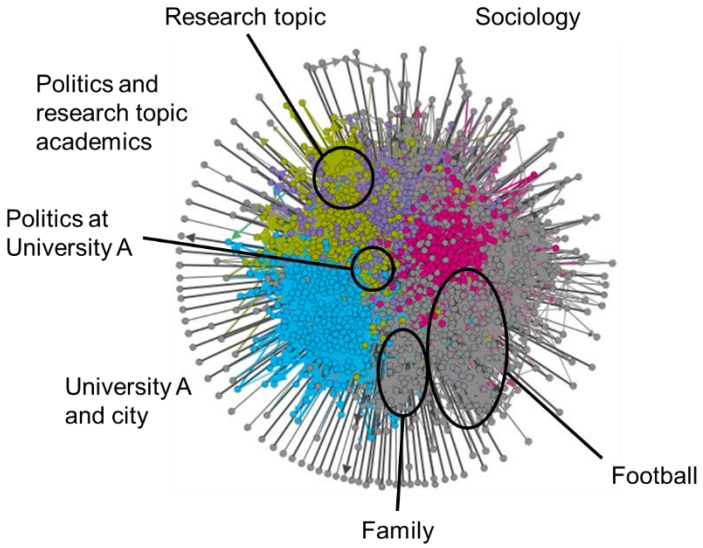


Figure 7.5.2: Jacob's Twitter ego-network.

His ego betweenness centrality is in the upper quartile, suggesting the presence of structural holes. The communities within his network reflect his research interests (at different levels of specialisation, from Sociology more generally, to Politics, and his specific interests), the city University A is located within, family connections and his interest in football. Jacob identifies the green community as being key to his professional work; "I built it and I worked hard on building it; it rose organically as well out of the work that I was doing and that there were people in there that strove to make me part of that network, by giving me speaking opportunities, by putting me in contact with other people."

Jacob has always used Twitter in a personal capacity as well as professional. He doesn't have a Facebook account; rather than dividing up his personal and

professional identities online, he simply does not post at all about things which he considers to be too personal, and mediates the amount and frequency of personal posting via Twitter since assuming his teaching role. Use of Twitter is not widespread amongst his departmental colleagues, whilst the majority do use Facebook.

He perceives Twitter to be particularly valuable as a mechanism for engagement and impact for the Social Sciences, in order to engage and communicate his work to a non-academic audience. Jacob particularly values the potential for making novel, unexpected connections on Twitter, and likens it to a conference coffee-break. In relation to his teaching role, Jacob currently shares his social media contact details with students and tweets about his research and shares stories which are relevant to his teaching. He is organising his first unit this year and hopes to be able to integrate social media to a greater extent, such as running a blog alongside a lecture series to keep students up-to-date with current events and refer back to in seminars.

7.6 Kieran

Kieran is a researcher in Geography, Earth and Environmental Sciences at 'University A'. His research specialism is interdisciplinary; "I label myself a Geographer but equally I could call myself a Science and Technology Studies [STS] person, I see myself as a Geographer that does STS if you like, but I increasingly see myself getting into history of Science and environmental history as well". He is currently at the end of his first postdoctoral fellowship, at University A, and will soon start a new fellowship in the Geography department at 'University B'. Kieran began his doctoral studies at 'University C', where he also completed an

MRes; he transferred to University A to complete his doctorate when his supervisor moved to the institution. As an undergraduate, Kieran studied Geography at ‘University D’.

Kieran uses Facebook, Mendeley and Twitter on most days, although he noted that he only uses Mendeley “for referencing purposes, rather than social networking”. He uses Google Scholar and ResearchGate on most weeks, and a blog on a monthly basis. Kieran’s survey response in relation to Academia.edu was “I once created a profile but have since deleted it”, but he now uses it preferentially over ResearchGate and his Academia.edu network was the focus of the interview.

Kieran first started using Academia.edu when he began his PhD; “I was very enthusiastic about social media and everything as one is at that stage, so I was running an Academia page and a ResearchGate page”. Due to the volume of email notifications, Kieran subsequently closed his Academia.edu account in order to focus upon ResearchGate. However, Kieran recently deleted his ResearchGate account and returned to Academia.edu; “I think I realised that actually more of the people that I was interested in following were actually on Academia.edu rather than ResearchGate”. Increased use of Academia.edu by his doctoral supervisor was influential in this decision.

Kieran's Academia.edu network, Figure 7.6.1, has only existed for a matter of weeks.

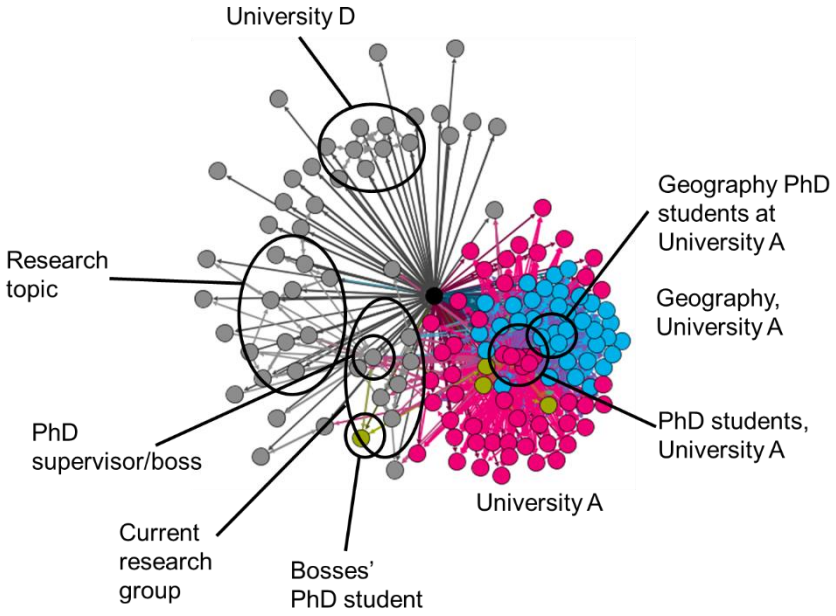


Figure 7.6.1: Kieran's ego-network on the Academia.edu platform.

In building this network, he targeted the 'sessions' used by his supervisor to look for novel people commenting on the work, and exploited his supervisors' followers and following list. The sessions feature allows academics to elicit peer review style comments from colleagues and the community when they upload a new paper. However, he notes that despite this strategy, he mostly follows people whose names he recognised and knows already, and whose work he knows he would like to keep up with.

In terms of the metrics used, Kieran's network is in the upper quartile for clustering. His network is dominated by a large, highly clustered community which relates to his current institution, University A. Subject–specific communities are identified both within the University A cluster, and a looser network of academics outside the institution. The looser research topic community has particular

significance for Kieran though, as it represents the movement of his research towards STS. Kieran believes that the location of his PhD supervisor, not within the University A cluster, reflects the fact that he has only joined the institution relatively recently.

Kieran started using Twitter at a similar time to first using Academia.edu and ResearchGate; “I think it was about that move to develop an online profile, ‘cos I very much see my Twitter account as a professional thing, if you like, it’s a space for my academic identity.” With Twitter, there was also an element of using it as a research site in itself, as his research topic is one which receives a good deal of active discussion between academics and the public on the platform. Kieran tries to maintain a position of being a detached observer in order to avoid becoming drawn into arguments. He does tweet about publications and conferences but tries to avoid too much “self-promotion” as “it sort of looks a bit cringe-inducing sometimes, when people do that stuff a bit too much”.

Kieran's Twitter network, Figure 7.6.2, is in the upper quartile in terms of out-degree, which may reflect his use of the site to gain information and caution in his own activity.

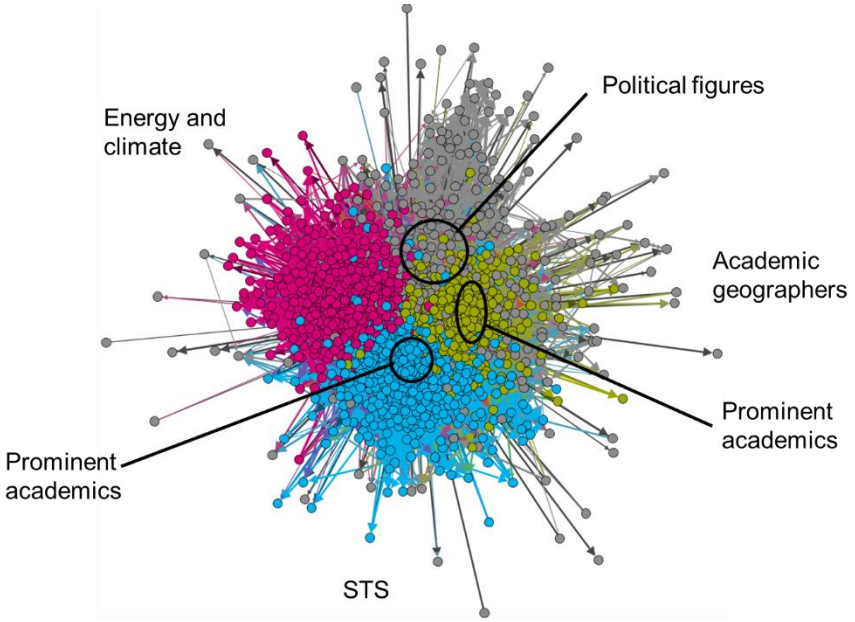


Figure 7.6.2: Kieran's Twitter ego-network.

His ego betweenness centrality is relatively high, indicative of structural holes and acting as a broker, which may be related to his research topic being at the intersection of Geography and STS. Kieran agrees that this accurately reflects his interdisciplinary research focus; "we've sort of got my disciplinary home in the green, we've got the theories that I'm using in the blue, and then we've got my empirical topic in the pink, so that's quite a neat mapping of that." However, as a result of these communities, Kieran is uncomfortable to an extent in his tweeting, in terms of who his audience is; "I never quite know if I'm there to tweet about [research topic] or whether I'm there to tweet about STS or [Geography], and I guess this ambiguity stems from the consciousness that I must have these three communities that are following me and who I was following".

Kieran's Twitter account was set up as professional from the outset, but notes that it is a site which blurs personal and professional. He will follow political discussions and enter into "jokey conversations" on Twitter, but generally only with people who he knows well already, and getting the "different registers of tone and language" right is key. Despite this, he has found Twitter to be a useful way of making novel professional connections, particularly within Europe, and gives an example of connections made through Twitter which nearly led to co-authoring an academic paper.

7.7 Lucy

Lucy is a professor at 'University A'. Her subject area is interdisciplinary in nature; "my training is in Biology and Biological Anthropology […] what I do is partly Natural Sciences, but I work on human data, and anything to do with whole humans is generally considered to be Social Science". She has been at her current institution for over three years; prior to this, she held positions at three other UK universities. She completed her doctorate at 'University D'. After her doctorate, she worked at 'University B' and 'University C', before moving to 'University A'. Her most frequently used SNS are Facebook and Twitter, not specifically academic tools, visiting the sites on most days. She uses Google Scholar on most weeks, ResearchGate on a monthly basis, and more rarely uses Academia.edu.

Lucy doesn't recall exactly when she started using ResearchGate; "It was a good couple of years ago though". She signed up after having received an email invitation from a co-author; she had used Academia.edu before joining ResearchGate, and switched as more of her American connections used the site.

Initially she actively sought people to follow, but now “if I happened to notice that somebody of interest is on there, then I will follow them.” She keeps her profile up-to-date with her research publications, and views it mainly as a personal repository. Her institution does have a repository, which she does use, but Lucy prefers ResearchGate as it is easier and quicker to upload papers; while Lucy can add citation information to the University A repository, uploading papers is carried out by a gatekeeper.

Lucy’s ResearchGate network, Figure 7.7.1, is relatively large; it is in the upper quartile in terms of nodes, in-degree and out-degree.

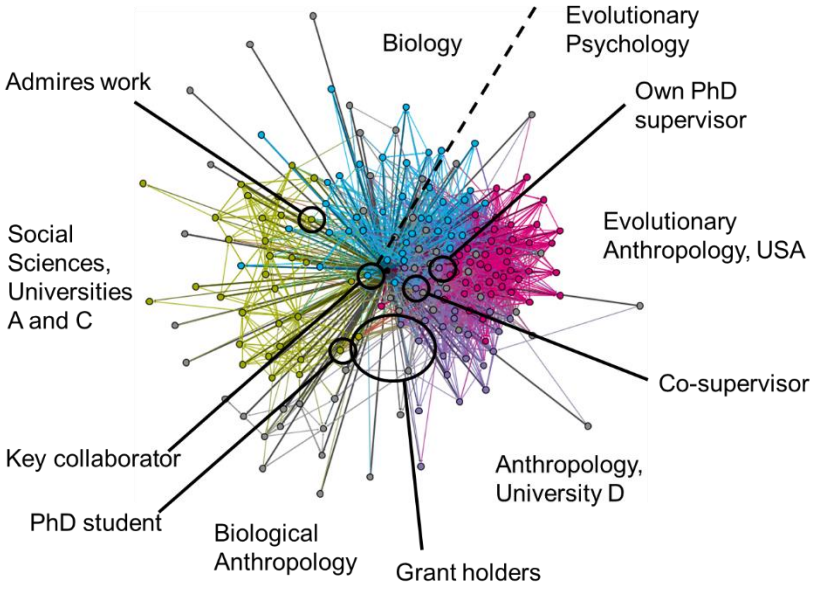


Figure 7.7.1: Lucy’s ego-network on the ResearchGate platform.

It is also in the upper quartile in terms of clustering; “I’m guessing that’s because of the interdisciplinary nature of what I do”. Communities “seem to fall out along disciplinary lines, but also partly along regional lines.” Lucy already has existing relationships with the majority of people in her network, and the communities reflect the institutional and subject-specific communities which she has become

embedded within. She notes that there are a small number of people who she hasn't met "but whose work I find interesting", and highlights an example.

Lucy notes that her key collaborators tend to be the ones closest to her in the network, and gives an example. A small group of nodes, which span two communities, have been particularly important in Lucy's recent work, as they represent team members from recent European grant. The purple nodes were former PhD students, and a postdoctoral researcher.

Lucy started using Twitter "a few years ago, although I think I was lurking for a few years before I started tweeting." Lucy set up her Twitter account as professional from the outset. She started using it in order to stay up-to-date with papers and blogs in her field. While her tweets are professional in focus, she does "follow a lot of people who are not just professional contacts", so the information she receives via the network is not exclusively professional.

Lucy's Twitter network, Figure 7.7.2, is also large, being in the upper quartile in terms of nodes and out-degree. It is relatively low (lower quartile) in terms of reciprocity.

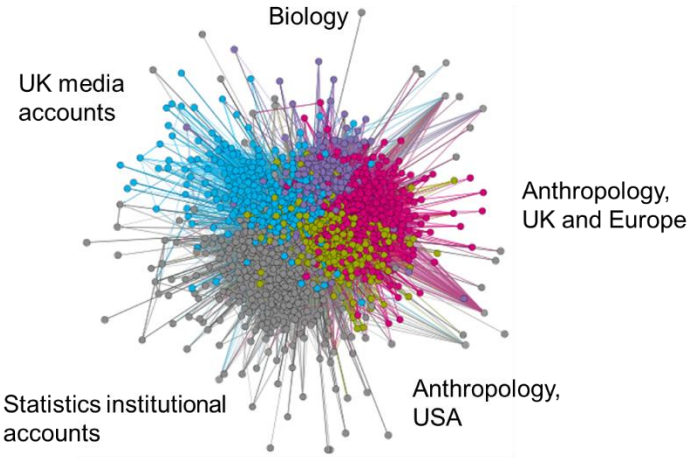


Figure 7.7.2: Lucy's Twitter ego-network.

With the exception of the mainstream UK media community, communities within the network relate explicitly to Lucy's research interests, reflecting the interdisciplinary nature of her work. She was surprised to see the distinction between Anthropologists according to geographical location; "I guess I tend to think of my networks along disciplinary lines rather than disciplinary and regional lines." Lucy agrees that she is more likely to follow people who she doesn't know already via Twitter, novel connections being generated "if other people have tweeted something interesting that they've tweeted, or if they followed me." Although no novel working collaborations have been fostered this way through the platform, useful new relationships do form; Lucy gives the example of a blog network which she has recently been invited to join, and believes that this was initiated through a key member accessing her papers through Twitter.

For Lucy, "Twitter for me is just about the transmission of mainly professional information." She tweets about numerous types of things which she has found of interest in relation to her work, such as new papers and blogs. She also tweets about her own new publications, but doesn't believe that Twitter is as effective at disseminating these items as academic SNS are. She "very very rarely" uses Twitter to live tweet from events, and finds reading tweets from conferences to be of limited use, if they do not contain links to full papers. Lucy emphasises that she views her use of the Twitter network in terms of gaining and disseminating information, rather than more social purposes. She will respond to interactions initiated by others, but is unlikely to start discussions herself, as she feels constrained by the 140 character limit. As such, she doesn't view it as an effective way of communicating with colleagues.

7.8 Marilyn

Marilyn is a professor at a Biological Sciences and Biochemistry department at 'University A'. Prior to joining University A two years ago, she worked as a lecturer in Biological Sciences and Biochemistry at 'University B', but also carried out research on open educational resources (OER). She worked in industry after completing her doctorate, before returning to academia initially in a role at 'University C'. She uses Facebook and Twitter most frequently, on most days. She has profiles on several other SNS platforms which she uses to varying extents. Most weeks, Marilyn uses a blog and Google Scholar. She uses LinkedIn and Slideshare on a monthly basis, and rarely uses ResearchGate.

Marilyn isn't sure when she started using ResearchGate; "they just kind of suck you in, I think. You just kind of see it, I really can't even remember, but then you see a publication then you go in and sign up, but I don't think I've ever fully understood what it was, so hence don't proactively go in and do very much." Her ResearchGate network, Figure 7.8.1, is small; it falls within the lower quartile in terms of nodes, in-degree, out-degree, and number of communities.

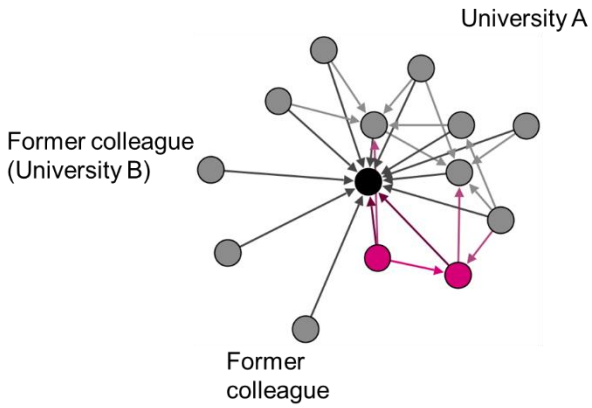


Figure 7.8.1: Marilyn's ego-network on the ResearchGate platform.

She does not follow anyone; as a result, her out-degree, ego betweenness centrality and reciprocity are zero. Her network is in the upper quartile in terms of network density. She doesn't recognise most of the members of the network; by looking at her ResearchGate profile, the community within the network appears to relate to University A. She identifies two of the peripheral nodes as colleagues from previous posts. "It's a bit like LinkedIn, it grows by itself sometimes."

Marilyn doesn't use her ResearchGate profile very actively or frequently, which she attributes her lack of following to. "I don't really, 'cos I don't understand the benefits of it. Like Academia.edu, I've never really got what that was about, I'd really need to sit down and explore it, and probably it sounds like it could be useful, so maybe I am missing out here, but it's never obvious or grabbed me in the way that other things like Twitter for example have." She has added papers to her ResearchGate profile, but she was prompted by an email rather than initiating it herself. She considers her blog to be the main home of her academic identity online (although she has project blogs, her personal blog is the "mothership"); she started blogging around 18 months ago, which was prompted by participating in a Massive Open Online Course (MOOC). Since then, blogging has found its way into her academic practice to a greater extent.

Marilyn started using Twitter in 2010. Initially, her use was not as a personal account, but via an account set up in relation to a project, as a means to "disperse my open educational resources on the Internet". Following the project, she started using Twitter personally, and it has become a key part of her academic identity online.

In contrast to her ResearchGate network, Marilyn's Twitter network, Figure 7.8.2, shows high levels of reciprocity and density.

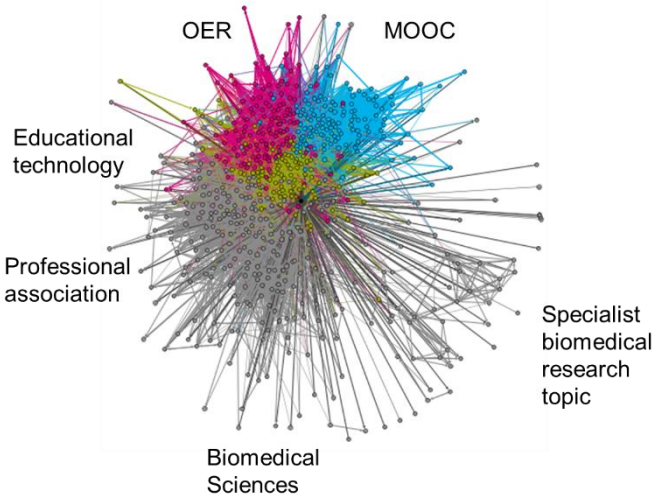


Figure 7.8.2: Marilyn's Twitter ego-network.

The communities within the network are defined by topics rather than institutional affiliations (Figure 7.8.2), although a community is identified relating to National Teaching Fellows (including Higher Education-related organisational accounts as well as personal accounts, and attendees of a professional association conference). Marilyn considers the communities to be quite well-defined and distinct; she also notes that the OER and the particular MOOC course communities make extensive use of self-identifying hashtags, and speculates that this may have created a tighter core to these communities.

Marilyn views the distinction between her personal and professional identities online as being blurred and not distinct, and through this blur "[you] unintentionally that you create a bit of a brand for yourself". The balance between personal and professional is modulated by the site; talking about her Facebook account, "I see that as the flip to Twitter, so Twitter's more professional with a bit of personal

slipped in, I think I see Facebook as entirely personal but I do have students, I do link to some professional groups, but if students friend me I'm you know in class I make it quite clear that this is our personal time and personal space, and I might occasionally have a glass of wine and swear, so there's a bit of disclaimer that goes with Facebook".

Marilyn views her online activities and her formal institutional role work as being "totally separate", noting that the university does not embrace social media, lacking a social media policy and not teaching social media literacy to students. Marilyn has an institutional webpage at University A, but there are restrictions on how freely this can be edited. While the university has a Twitter account, she doesn't feel that use of social media is viewed in positive terms by the institution. However, Marilyn's activities on Twitter have led to collaborative academic publications, for example, despite the fact that she is "mainly doing all of this stuff outside of work hours, so it is a complete mess and a blur."

7.9 Nicola

Nicola is a lecturer in Dance, Drama and Music at 'University A'. She studied for her undergraduate degree at an overseas university ('University B'), and completed Masters degrees at 'University C' and a different overseas university ('University D'). She undertook her doctorate at 'University E'. Her academic background spans the Social Sciences and Humanities. Nicola considers herself to be an active user of social media in her professional life. She uses Google Scholar and Twitter most frequently, visiting the sites on most days. She uses Academia.edu, a blog, LinkedIn and Zotero on most weeks, and Facebook on a monthly basis.

Nicola was a relatively early adopter of Academia.edu, which she started using around 2006. She tends to be an early adopter of online technologies and platforms, which is reflected in why she chose to create a profile on the site. Her use of the site has shifted since the early days; “I used to use it more as a proper social networking tool, but sometime in the last few years I feel like Academia[.edu] shifted something, and suddenly my feed just exploded with all sorts of irrelevant stuff.” Since then, her profile has fulfilled more of a CV-type role, which has been particularly valuable in being visible online while job hunting post-doctorate, particularly when in a teaching-only role which did not afford her a presence on the institutional website. Being able to make her publications accessible, and having portability between institutional affiliations, has been particularly valuable. Although she is now in a permanent position at University A, it is quicker and easier for her to place her papers online on Academia.edu than via their institutional repository.

At first glance, Nicola did not recognise obvious distinctions between the communities in her Academia.edu network, Figure 7.9.1.

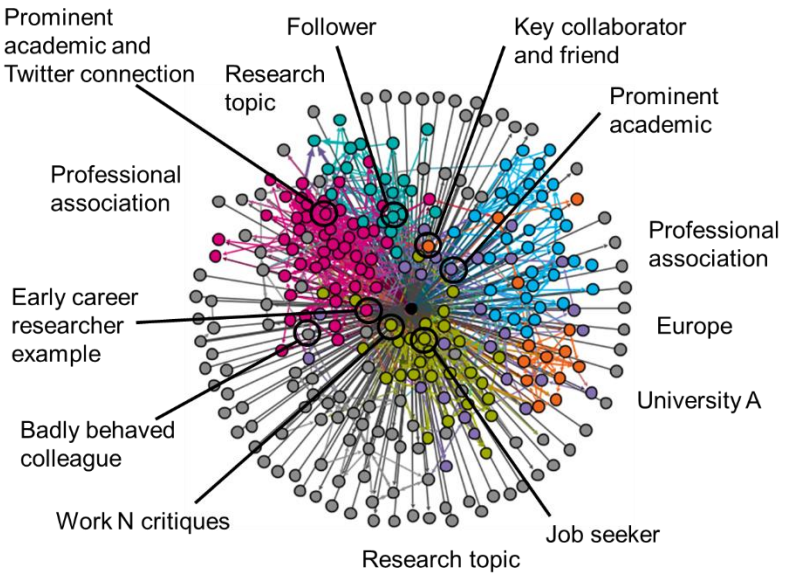


Figure 7.9.1: Nicola's Academia.edu ego-network.

Her network is relatively large, being in the upper quartile of the data in terms of nodes, in-degree and out-degree. It comprises an unusually high number of communities (seven, placing her in the upper quartile of the data), but is the second lowest in density in the sample overall. The ego betweenness centrality is relatively high, suggesting that Nicola is acting as a broker between the communities. There is a lot of overlap between the communities, which reflect different subject areas and geographical locations in which Nicola has studied and worked. Only one community is defined in relation to an institution; the orange community is a small but distinct community of academics relating to her current institution, University A. Two of the specialist research topic networks may also be linked to participation within professional associations in those fields.

The pink community is where Nicola would locate her current work and contains key research contacts. This community includes a high-profile scholar whose work Nicola admires and she believes could be an important connection for her future career. Although he is a role model in a sense, their personal professional relationship was fostered via Twitter, where Nicola became known to him. They subsequently met at a conference, and the high-profile scholar introduced himself. In contrast, Nicola also highlighted two connections who are part of her network, but she would like to distance herself from professionally. Within the green network, Nicola highlights someone who has recently completed a PhD overseas, and she believes he follows her on multiple platforms as he sees her as a key connection in order to get a job in the UK; “I don’t really rate him, but I feel it’s a bit unkind to unfollow him or to block him or anything, but I guess that’s one thing about networks is that it’s not necessarily people who you are keen on.” She also flagged one colleague who “was a really badly behaved colleague who caused problems and so I thought it would be better not to follow her because she would have seen it as solidarity so it was just better politically to not have any connections with her, even social media.” This node is not closely aligned with a particular community, so other colleagues may have held a similar view.

Nicola started using Twitter in early 2011. She created a profile specifically for a job vacancy she was applying for, which listed ‘web 2.0 proficiency’. She asked a close colleague and friend to introduce her to the site, and has since found it to be very useful in her professional work. Her network was professional in nature from the outset, and has largely remained that way. Although she didn’t get the job which prompted her to sign up, it has been useful in her job search; “this is a place where I can shout about how awesome I am, particularly where I had a temporary

teaching job and my university certainly isn't promoting me or doing anything to support my research". In her role as a temporary lecturer, Twitter offered a platform to maintain a profile and be active as a researcher; "I was strictly a lecturer teaching at the time, and so Twitter was a place where I could be transparent about the fact that 'hey I am a researcher too'." She does tweet occasionally about hobbies such as running, because she knows that some academics in her network share her interests, although she is cautious of being too personal as she has students in her network. She was recently reprimanded by University A for tweeting about marking dissertations, and has been told to not tweet about students under any circumstances. The university does not have a social media policy, so this is not a consistent rule.

Nicola's Twitter network, Figure 7.9.2, is relatively large, being in the upper quartile in terms of nodes, out-degree, and number of communities.

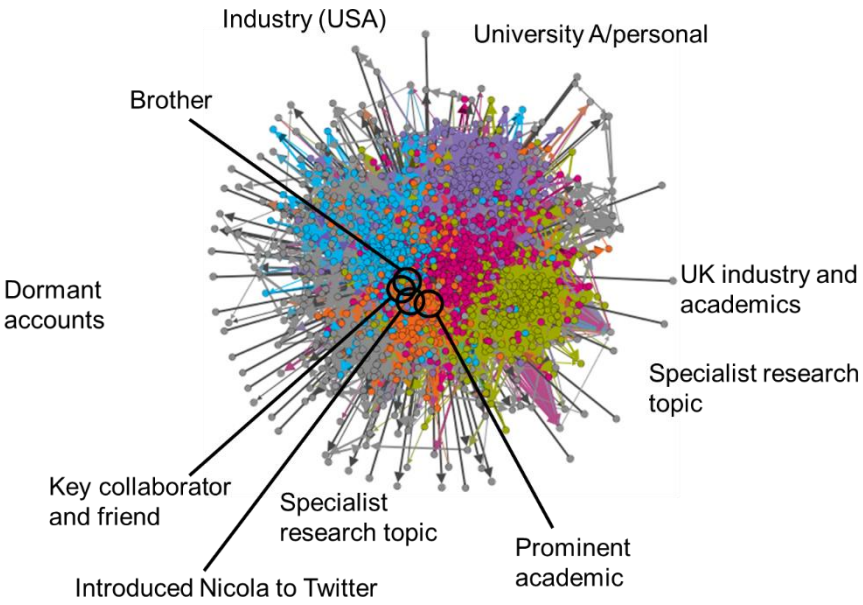


Figure 7.9.2: Nicola's Twitter ego-network.

Her network density is relatively low (lower quartile) and her ego betweenness centrality is high (upper quartile), which would suggest the presence of structural holes and that Nicola is acting as a broker between communities. The communities are defined according to a variety of factors. Three communities relate to specific research interests, sharing the same focus but being divided by geographical location. The orange community is key to her current work; “these are my best buds, these are my people I see on Twitter, these are the people I care about, but they’re like the pink network on Academia[.edu]”. Nicola also identifies the key collaborator from her Academia.edu network. Communities also relate to the theatre industry, again divided according to geographical location. This reflects the fact that Twitter has become a research site in itself for Nicola; “it kind of lets me track this subject, and I’m also looking at the subjects’ use of social media, if that makes sense, and what that then reveals for my research. So you could say that as a result of the networks, I’m now researching social media, because in the subject I research, social media matters to it.”

Nicola is more likely to connect with people who she doesn’t know already on Twitter. She perceives that using Twitter has yielded many benefits for her professional life, particularly in terms of building rapport with people before meeting them in ‘real life’ (such as conferences), being offered opportunities such as writing articles, and building a network of professional contacts who can be asked for assistance.

7.10 Oliver

Oliver is a professor in Archaeology and Classics at ‘University A’. He has worked at several UK higher education institutions. He completed his PhD in 2003 (at

‘University B’) and held a postdoctoral position at ‘University C’. He held another postdoctoral position at ‘University D’, before returning to ‘University B’. He also worked as a lecturer at ‘University E’ and ‘University F’. His undergraduate degree was undertaken at ‘University G’, and he studied for a Masters degree at an overseas university (‘University H’). Oliver uses a variety of social media platforms, to differing extents. On most days, he uses Facebook and Twitter; on most weeks, he uses Academia.edu, ResearchGate, and a blog (he has two project blogs). Less frequently, he also uses Google+, Google Scholar, LinkedIn, Slideshare and Zotero.

Oliver started using Academia.edu in 2010, because other academics he knew had started using the site; “Peers were doing it, and you get information, that’s really the one value I would say, you get alerts about somebody maybe you’re following has posted their latest article or something.” Oliver’s Academia.edu network, Figure 7.10.1, is relatively large; it is in the upper quartile in terms of nodes, in-degree and out-degree.

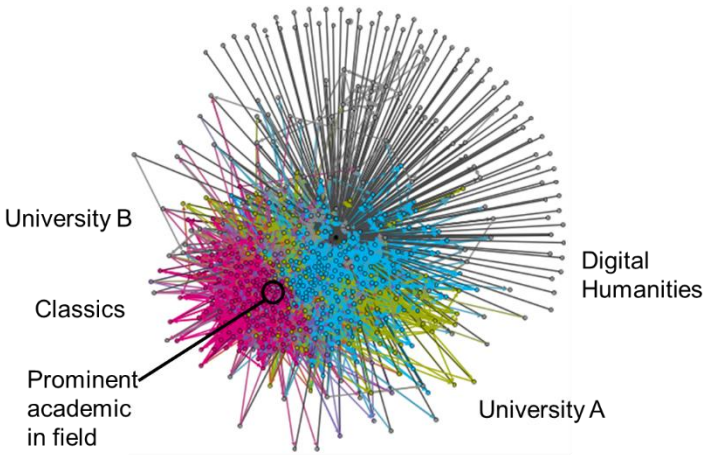


Figure 7.10.1: Oliver’s Academia.edu ego-network.

It shows high reciprocity (upper quartile), and low density and ego betweenness centrality (lower quartile). This suggests that Oliver has become highly embedded within his research field, reflecting his status as a reader.

The network structure includes larger communities defined by Oliver's research interests, and smaller communities defined by two of the institutions he has been affiliated with. The grey nodes are mostly unknowns, but includes some people who Oliver knows but doesn't follow back. In comparison to Twitter, Oliver is more likely to already know the people who he chooses to connect with on Academia.edu; "it's much more likely that I'll already have some kind of personal connection, either because I've been a colleague with them at the same institution, or they're friends, or they're names I recognise, either from a book or within my field." Oliver highlighted an example of a prominent academic who fits this description.

Oliver started using Twitter in 2010, after he joined University A. Starting to use Twitter was related to attending a seminar on its academic use in a different department of the university. In comparison to the other networks in the sample, Oliver's Twitter network, Figure 7.10.2, is unusual in terms of one metric; his ego betweenness centrality is in the lower quartile.

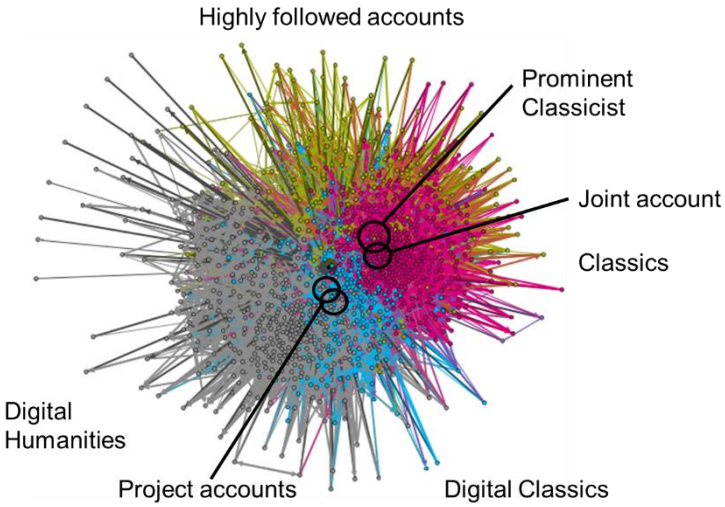


Figure 7.10.2: Oliver's ego-network on the Twitter platform.

The communities within his network closely align with and accurately reflect his research interests – Classics, Digital Humanities, and at their intersection, Digital Classics. The nodes are a mix of personal, institutional and organisational accounts within these fields. He highlights in particular a prominent Classicist, and several project Twitter accounts he runs.

Twitter has become integrated into Oliver's academic practice to a greater extent than Academia.edu; he uses the site on a daily basis, although notes that "sometimes I have to go on detox for a week or two weeks, it can be very intensive, but I try to look as one of the first things I do in the morning or kind of when I get bored or have a cup of tea, instead of reading the newspaper." Oliver states that he doesn't "really tweet much, it's more a case of getting information, retweeting", although he will tweet more actively when attending events, and conferences are a driver for network activity. He also uses Twitter as a way of keeping notes, archiving and sharing useful links; "That's one of the reasons for retweeting, for favouriting, there's a record then I can just go back through and

check where did I see that. But I suspect I don't do that as much as I think I would, but that's partly because it's quite difficult to search."

Oliver is more likely to follow novel connections through Twitter than Academia.edu ("It's a little bit more anarchic in that sense, you follow who you want to follow, and what's great is that you also then have ways of reaching the followers of the people you follow or their communities"). However, following is still often linked to face-to-face meetings and relationships, reinforcing existing relationships, and acting as a precursor to meeting new connections at in-person events. Oliver does not view his Twitter account as exclusively professional, but rather recognises that there is a blurring of the personal and professional (although it is more professional than Facebook). "There'll be some social stuff too, not generally you know I had cereal for breakfast, not that kind of thing, but some political stuff, if there's stuff in the news to retweet or to comment on, then I will use that." He feels free to network in his position as an academic; he acknowledges that there is potential for conflict in this space, and is highly aware that it is a public sphere, but has not encountered problems himself.

7.11 Quentin

Quentin was a researcher in Politics at 'University B' when he took part in the survey. He currently works at 'University A', in an academic role which includes some research. He studied for his PhD at 'University C'; he also undertook a short term postdoctoral position at University C, and a subject specialist Research Institute. He completed his undergraduate degree at 'University D', and a Masters at 'University E'. Quentin most frequently uses Facebook and Twitter, using the sites on most days. He uses Academia.edu, a blog, Google+, Google Scholar and

LinkedIn on a monthly basis. Quentin has also created profiles at Mendeley, ResearchGate and Slideshare, but hasn't used them since.

Quentin started using Academia.edu in 2009, during his PhD, and views creating a profile as part of the role of being a PhD student, in order to connect with and keep up-to-date with publications from key members of the field. He noted a perception that students are engaging with platforms like Academia.edu now at earlier career stages, and increasingly now join as undergraduates. Since finishing his PhD and pursuing a postdoctoral academic career, Quentin's focus has shifted toward considering his profile as an online business card, "in case somebody was Googling me or that kind of thing, so I did use it that kind of soft way, not a hard CV but just enough content to show that yes I was doing things, I was doing a breadth of things, and kind of links out to some of the things that I was using a bit more."

Quentin's personal network on the Academia.edu platform is shown in Figure 7.11.1.

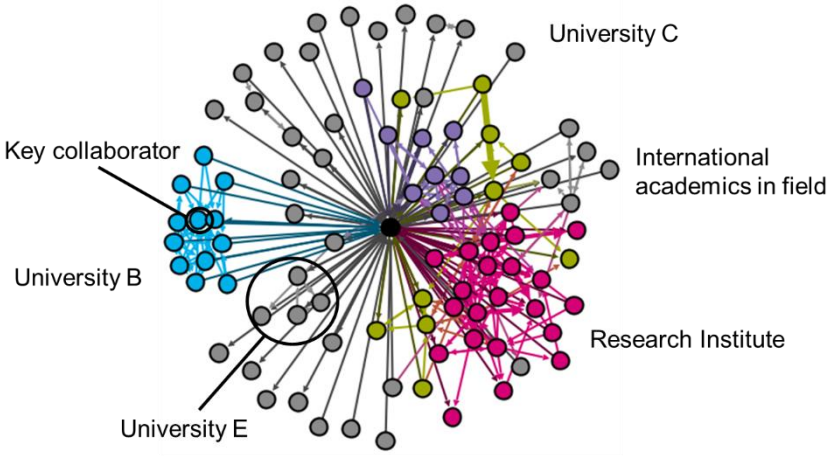


Figure 7.11.1: Quentin's ego-network on the Academia.edu platform.

Only one metric lies within the upper or lower quartile of the distributions; his network is relatively low in density. The communities in Quentin's Academia.edu are mainly defined by institutional affiliations, although the international academics are defined by shared research interests. Note that while the nature of the blue community was not obvious to Quentin, it contained a key collaborator, and he suspected it to be a community mainly comprising students at University B; he gave permission to follow it up by viewing the profiles and this was confirmed to be the case.

Quentin's Twitter network, Figure 7.11.2, lies within the interquartile range in terms of all metrics.

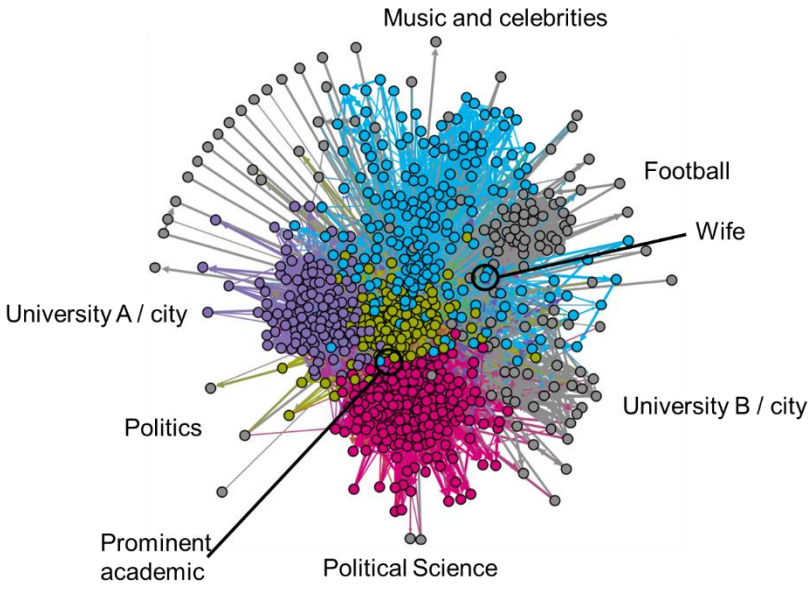


Figure 7.11.2: Quentin's Twitter ego-network.

He started using the site earlier than Academia.edu, as a Masters student (circa 2005). Initially, he used the site in an entirely personal capacity; "I didn't think of [it] academically, friends were doing it, various celebrities were doing it, and it was a way to be connected with music and bands and all sorts of things". Since then, Twitter has found its way into Quentin's academic practice and he does actively

tweet about his work. Its roots in personal use are still reflected in the network structure, in communities related to personal interests such as music and football, although a large proportion of the network is also attributed to research interests (Political Science), and his personal political views and role. Two communities were identified which relate to institutions, although this is in the sense of the cities that those institutions are part of and Quentin was resident in at the time.

Although Quentin's Twitter use began as a personal activity, he started using it in his professional life in 2008, whilst studying for his PhD. Quentin's professional use of Twitter is important as a source of information, and as a way of maintaining social, professional connections. Twitter can act as a way of reinforcing existing professional connections, generating new connections around conferences, and creating a social connection with others ahead of face-to-face meetings. Quentin highlights the example of an EU collaborative project which he is involved in, which he views interactions with academics on Twitter to have been instrumental in securing.

Striking a balance in the mix of personal and professional activity when tweeting is an issue which Quentin is aware of. This risk of alienating parts of the network can pose a challenge, as is finding the right amount of personal information to include in tweets. Quentin perceives this to be important to have "authenticity" when tweeting, but not to the extent that it will "annoy people". He is also conscious of the fact that he works for an institution and activity on Twitter is a public space in which he represents the institution to an extent; "as a professional, forward-facing member of staff of the university it's knowing when to, I don't tweet too provocative things on Twitter but it's striking a balance really that what's credible for my employer and the people who are paying my wages and about my own opinion."

7.12 Rachael

Rachael is a lecturer in Culture and Media Studies at ‘University A’. Prior to this, she held a postdoctoral fellowship at ‘University B’, where she had also undertook her doctorate. As an undergraduate, she studied at an overseas university (‘University C’, in ‘Country X’). Rachael uses a variety of social media platforms, with notable frequency. She uses Facebook, Google+ and Twitter daily; on most weeks, she uses Google Scholar and Slideshare. Rachael uses Academia.edu and LinkedIn on a monthly basis, and although she has a blog, she uses it less frequently.

Rachael doesn’t recall exactly when she started using Academia.edu, although it was probably during the last three years, since she joined her current institution. She chose to join the site because links to the site started to appear when searching for research literature. She “[doesn’t] use it very often, but it is a useful resource”; it has been a useful way to find and connect with people working on her research topic, and secondly as a place to host her online portfolio. As an academic, she feels obliged to an extent to use it. She has heard of ResearchGate, but hasn’t created a profile there, as Academia.edu seems to be used in her research community to a greater extent. Although she uses the site to keep up with new publications in her field, she hasn’t uploaded papers herself.

Rachael's Academia.edu network, Figure 7.12.1, is relatively high in density and reciprocity (being in the upper quartile for both metrics).

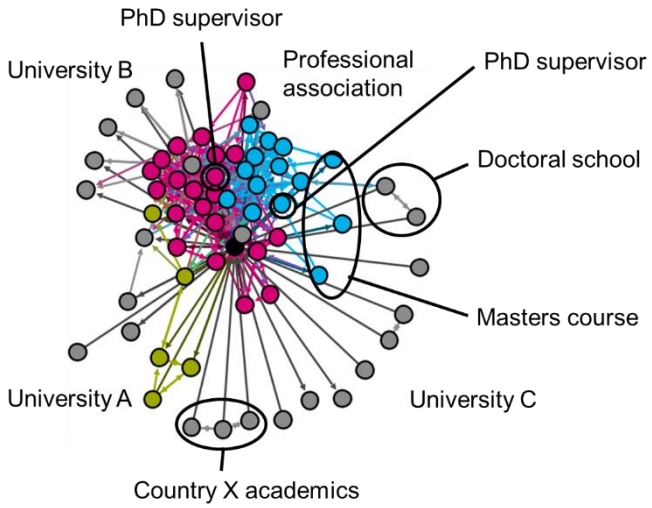


Figure 7.12.1: Rachael's ego-network on the Academia.edu platform.

She personally knows most of the people in her network. The grey, unconnected peripheral nodes mainly relate to her time as an undergraduate at University C. Her current institution is represented by a distinct but small community (in green). The overlap between the pink and blue communities makes it hard to distinguish exactly what sets them apart; members of both communities share research interests in Internet Studies, and are or have been connected with University B. On closer inspection, it is possible that the pink community are more closley related to University B (tenured faculty, doctoral students), while those in the blue community may have had more fleeting relationships with the institution, but remain active in the Internet Studies community.

Rachael started using Twitter "about 2010", predating Academia.edu by two or three years. She initially started using Twitter as part of a research project, being responsible for their social media activity, and subsequently created her own

account. There is a lot of overlap between communities in Rachael's Twitter network, Figure 7.12.2, which makes it difficult to pinpoint distinguishing characteristics between them.

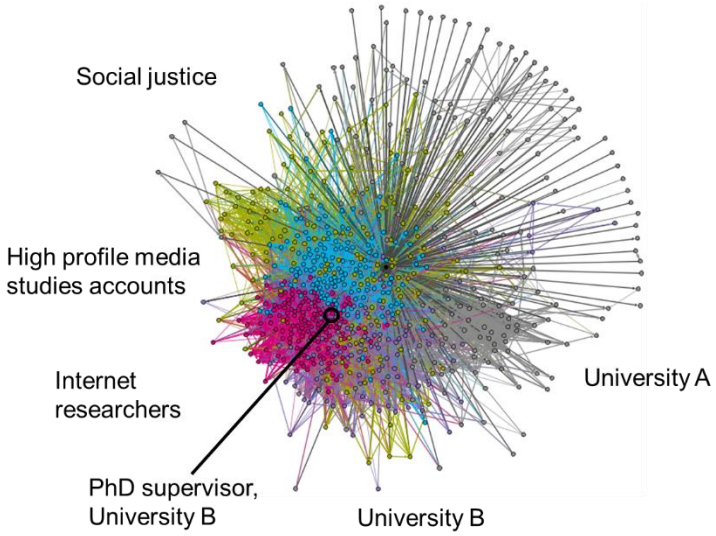


Figure 7.12.2: Rachael's Twitter ego-network.

Her network is relatively low in reciprocity (lower quartile). "When I looked at this, visually it's amazing […] I looked at this and it's absolutely amazing to visualise my Twitter network in this way, it's just like quite overwhelming." The communities within her network relate to institutions and research interests. The distinction between the pink and blue communities is not clear; all could be considered media scholars, although the blue community may be more highly followed accounts.

Although Rachael uses Twitter more actively than Academia.edu, she is "also a little sporadic, I don't use it every day, I sort of have peaks and troughs". As she is at a "teaching-heavy institution", she uses Twitter most actively when at conferences and events, to complement the face-to-face discourse; "it's a great way to kind of see what other people are saying and connect that way." Rachael does use Twitter in her teaching, but has experienced issues with its use with students; "although there's a lot of expectation that they're digital natives, a lot of

them aren't and a lot of them have really quite serious privacy concerns […] there's a lot of sort of personal social cultural sometimes religious sometimes privacy issues related to using social media in the classroom so although I do use it, I also try to manage boundaries for students and for myself on it".

Rachael views Twitter as a mix of personal and professional, and sees this as being part of the logic of the platform; "the nature of Twitter is kind of this weird mix, so generally, from what I understand, it's like it's personalised, right, so it involves being a little bit personal, if that makes sense." Rachael's Twitter network is a way of maintaining connection with her previous institution, University B. "[University B] features a lot in my network, quite unsurprisingly". Her current university does not have a high research profile, in contrast to University B; Twitter provides a mechanism for her to stay in touch with the research community, and views her online identity as being strongly connected to University B.

7.13 Summary

A summary of the results observed across the cases in relation to the RQs is briefly outlined below; the full cross-case thematic analysis will be discussed in Chapter 8.

7.13.1 What are the structural characteristics of academics' online ego-networks on social networking sites?

The interviews allowed annotation of the network structures from Chapter 6, to understand the types of communities academics connect with (Figure 7.13.1.1; full data for the tally is shown in Appendix H). In the context of academic SNS, pre-existing institutional affiliations are more likely to define communities. Research topics can define communities on both platforms. Personal interests may also play a role in defining communities on Twitter.

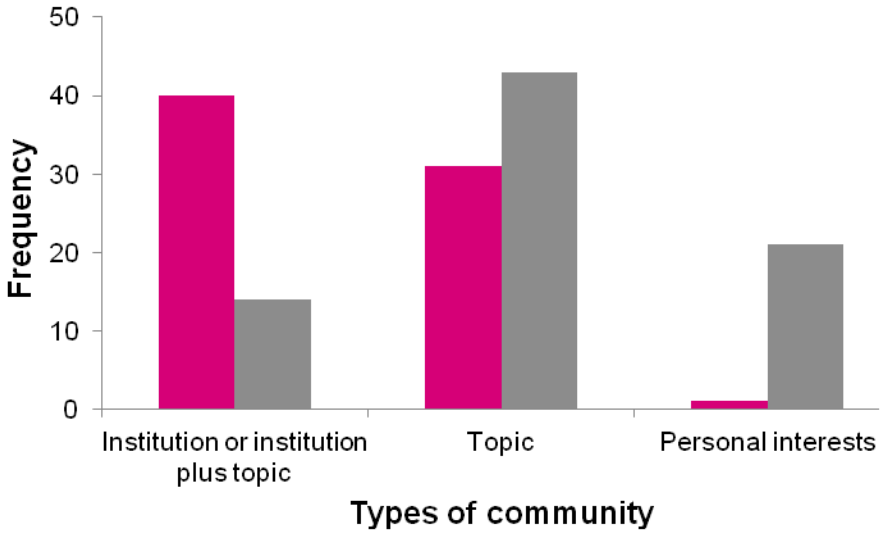


Figure 7.13.1.1: Frequency of different types of community on each platform. Pink bars represent academic SNS, and grey bars represent Twitter.

7.13.2 How do academics construct and understand their ego-networks?

Across the interviews, participants explained how they perceive links between the structure of the networks fostered by the platforms, and how they use the platforms concerned. Differences in the ways that academics conceptualise the different platforms and social factors in the Higher Education context within which they work mediate this relationship. Qualitative analysis (as described in Section 4.3.3) was conducted on the interview transcripts to elucidate themes (summarised in Figure 7.13.2.1; see Figure 4.3.3.2 for a graphical representation of the process which led to them).

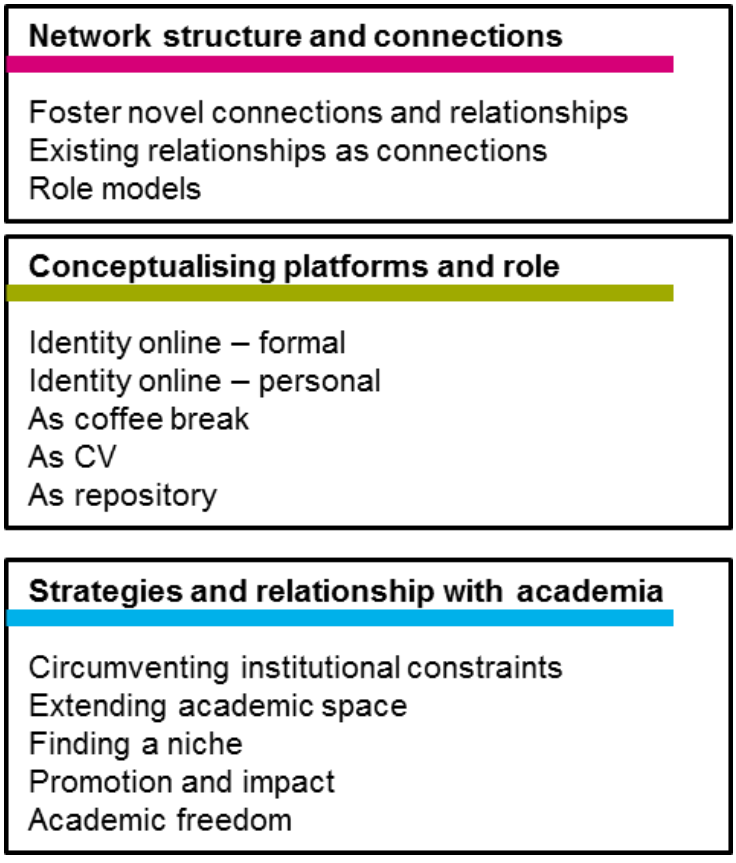


Figure 7.13.2.1: Emergent themes from qualitative cross-case analysis of the interviews.

Themes in the relationship between use and network structure will be discussed in detail in the next chapter.

7.13.3 Does the structure and/or role of the network differ in nature according to academic career trajectories?

Although the interviews confirmed the earlier finding of disciplinary differences in use of particular platforms (Academia.edu or ResearchGate) (Chapter 5), no further obvious disciplinary differences were apparent. The relative frequency of use of codes in the qualitative analysis, according to discipline, is shown in Table 7.13.3.1.

Table 7.13.3.1: Matrix coding query of themes according to discipline.
Figures shown as a percentage of participants within each discipline.

	Arts & Humanities (n = 5)	Natural Sciences (n = 7)	Social Sciences (n = 6)
1.1 Foster novel connections and relationships	80	43	67
1.2 Existing relationships as connections	100	86	83
1.3 Role models	60	29	33
2.1 Academic identity online – formal	100	57	83
2.2 Academic identity online – personal	100	43	83
2.3 As coffee break	0	14	17
2.4 As CV	40	14	50
2.5 As repository	60	29	50
3.1 Circumventing institutional constraints	20	29	33
3.2 Extending academic space	80	57	33
3.3 Finding a niche	60	57	67
3.4 Promotion and impact	40	14	50
3.5 Academic freedom	60	43	50

Some aspects of network structure and perceptions of networks were found to differ according to job position. The output of a matrix coding query shows the relative frequency of codes assigned according to job position in Table 7.13.3.2.

Table 7.13.3.2: Matrix coding query of themes according to job position.
Figures shown as a percentage of participants within each job position.

	PhD student (n = 3)	Researcher (n = 5)	Lecturer (n = 6)	Professor (n = 4)
1.1 Foster novel connections and relationships	67	60	33	100
1.2 Existing relationships as connections	67	100	100	75
1.3 Role models	33	20	50	50
2.1 Academic identity online - formal	100	60	67	100
2.2 Academic identity online - personal	100	40	67	100
2.3 As coffee break	33	0	0	25
2.4 As CV	67	20	50	0
2.5 As repository	67	20	17	75
3.1 Circumventing institutional constraints	33	0	17	75
3.2 Extending academic space	33	40	83	50
3.3 Finding a niche	100	100	33	25
3.4 Promotion and impact	33	20	50	25
3.5 Academic freedom	67	40	50	50

This gives an indication of divisions between the strategies used to develop networks according to different phases of academic careers, which will be discussed in detail in Section 8.2.3.

8. Discussion

This chapter will present a cross-case analysis, drawing upon data from all phases of the research study, as described in the previous three chapters, in relation to the RQs.

This chapter will demonstrate that:

- Academics' ego-networks on academic SNS and Twitter reflect institutional and disciplinary affiliations. Academic hierarchy also plays a role in network structure, and personal interests in the context of Twitter.
- The structure of academics' ego-networks differs according to platform. Different patterns of connections are fostered on different sites, and this relates to how academics view the role that the platform plays in relation to their professional life.
- A number of ways in which interacting with social media platforms modulates the role of academics in relation to the formal institution are identified. Different pressures are active at different career stages.

8.1 What are the structural characteristics of academics' online ego-networks on social networking sites?

This question was primarily addressed by the network data (Chapter 6). Additionally, network structures were annotated with information from the interviews in order to characterise how communities are defined within the different networks (Chapter 7).

Trends in the data show that academics' personal networks developed on academic SNS are smaller, more dense, more highly clustered around discrete

communities and showing greater reciprocity. In contrast, Twitter networks are larger and more diffuse. To illustrate these differences in network structure, the networks of an approximately 'average' academic in the sample are shown in Figure 8.1.1.

Figure 8.1.1: Personal networks of an Arts and Humanities lecturer whose personal networks on both platforms are approximately average size overall
Left, Academia.edu, ranked 21st; right, Twitter, ranked 27th.

Academic hierarchy is reflected in network structures, with seniority and institutional affiliations playing a greater role in influencing network structure in academic SNS compared to Twitter. On both types of platform, professors show the highest average number of followers, and the largest disparity with the number of people that they choose to follow. In stark contrast, while graduate students have the fewest average number of followers and following on academic SNS, they follow the most on Twitter, and have second highest average number of followers after professors. Researchers and lecturers show intermediate levels of followers and following on both platforms, with lecturers exhibiting a greater number of followers than following on average compared to researchers on both platforms. This replicates findings published from the pilot study (Jordan, 2014a). It reinforces findings from analysis of Academia.edu profiles (Menendez, de Angeli &

Menestrina, 2012) and ResearchGate network analysis (Hoffmann, Lutz & Meckel, 2014; Hoffmann, Lutz & Meckel, 2015), which both suggest that academic SNS serve to preserve formal academic hierarchies. These trends in network structure suggest that academic SNS may preserve offline relationships and existing academic hierarchies to a greater extent than Twitter, reflecting differences in social capital more broadly facilitated by the different sites.

The concept of social capital provides a lens for considering the network structures in relation to the over-arching question of how online networks may be reshaping academic roles and relationships. Links between network structure and social capital were introduced in Chapter 3; to recap, social capital can be defined as the advantages conferred to an individual through their position within a social structure (Burt, 2005). A body of work has explored how social network structures correlate with social capital (Chapter 3); social capital is often linked to where an individual sits in relation to different communities. Greater bonding social capital is associated with being part of denser, more cohesive network structures, while bridging social capital is related to positions (such as brokers) linking different communities (Crossley, Bellotti, Edwards, Everett, Koskinen & Tranmer, 2015). Both bring attendant benefits and constraints; for example, those with high bonding capital may experience the benefits of solidarity but be constrained by social norms, while those with high bridging social capital may lack support but gain benefits from performing brokerage roles (Burt, 2005).

Online social networks have been identified as potentially changing the dynamics of social capital, by offering a mechanism to reinforce weak ties and making latent ties (those which could exist but do not at present) visible (Haythornthwaite, 2002). However, in practice, online networks may also simply serve as an additional

channel to reinforce strong ties (Haythornthwaite, 2005). The network structures observed here suggest that reinforcing strong ties is more likely the role being played by academic SNS (the majority of connections on academic SNS being existing relationships is discussed further in Section 8.2). This was confirmed by the interviews (see also Section 8.2).

> "I'm fairly new to ResearchGate, so I don't have a very big network built up on that, it's actually slightly pathetic [laughs*]. I tend to use it to connect to people who I've published work with*". - Gillian

> [Academia.edu] "They're probably mostly people that I know already, either in a personal capacity or from knowing their work, and they're people that I generally want to get updates from, […] me going through the list of discussants on [boss]'s piece, that was partly an exercise in trying to find out who maybe I don't know, who I should know of, and trying to figure out new people to follow perhaps. But as far as I remember, I don't think I found that many people who I thought were terribly close to what I'm interested in." - Kieran

Twitter serves to both reinforce existing ties, and activate latent ties more readily.

> [Academia.edu] "Yeah, they're people that I kind of know of, or have been in a department with, or I've been a student with, or I've worked closely with. […] But by and large *it's a network of people who I have met in person […] it's people that I know, not people who I want to get to know*." - Carol

> "I might not know them, in that I've never met them, but I know someone else that works in their department or we have a co-author in common or something, we know each other, and we'd be happy to stand and chat if we met at a conference, but that just hasn't happened yet."- Frances

For example, Harriet describes how Twitter can activate latent ties with previously unknown academics, and how having this type of connection can translate into social capital:

> "I think there are circumstances where I have either been approached or approached somebody that I felt more confident about engaging with because I'd interacted with them on Twitter, so in terms of building some kind of capital, be that social or professional capital, it definitely works for that. […] it's about feeling a sense of connection to people, and some of the really jokey things are great for that, they're really really good for that, like this person I was interacting with yesterday morning who I'm sure I have met but I don't know, and so she wrote this haiku and I favourited it, and she like just got back to me and said could you do one about [research topic] and I thought oh wow, she knows my research, and so then I did but as part of it I got into a conversation with her about Shetland ponies, so when we meet, which probably will happen, we'll be really friendly to each other, and without Twitter that's not going to happen, you're not going to have an email exchange with somebody like that. It's the kind of thing that happens at a conference over a cup of coffee or whatever, but it takes much longer to happen. I'm quite secure in my job, I'm quite senior, I'm not looking for a lot of help from people but I spend a lot of time reading CVs and shortlisting people and appointing people and I know how hard it is and how those things play out and people having warm fuzzy feelings about you is good, it matters." - Harriet

Nicola, Rachael and Quentin described several examples of how social capital can be leveraged from their online networks in relation to their professional practice:

> "I just followed someone today in Hawaii, who […] [loads Twitter profile] so this guy, I don't know him, but look what he's hashtags [lists hashtags], I mean that's a no-brainer, but he's in [Hawaii], I've never met him, somehow he found me. […] So many things have happened for me because of my Twitter network, […] will you be the external examiner for this viva, or will you be our course external examiner, or I got asked to write something for The Conversation, and that would be because of either Academia or Twitter, PhD students finding me, people just staying in touch because I get Twitter and I know how to come across as a real person and well rounded and fairly interesting, people feel like they know me, so I've had people come up to me at conferences who are perfect strangers in real life, and they'll be like '[Nicola] it's so and so from Twitter, big hug!' even though it's a perfect stranger I've never met before but I see them every day on Twitter, and then that person is writing a book chapter for me, or they're, this actually happened with [name], [name] who I knew on Twitter first, he approached me at a conference, he is writing a book chapter for me, and he Skyped with my students last year, so like you can't get more out of Twitter than that, it's like the network re-creates itself in my work by how I use the people in my network, if that makes sense. Because we engage about academia, about the theatre industry, about teaching, about job hunting, about triathlons, that manifests itself in real life. So yeah, I've just had so much happen because of Twitter, so I can't stop advocating for it because you know you can promote yourself, you can develop a rapport, I think that's really a key word is that kind of like with this digital humanities scholar that's in the states, I've seen her like maybe five times in my life, but I can email her and say '[name], I've got this seminar, and I'm doing this with digital humanities, what should I get them to read?' and she'll answer the email within 24 hours 'cos it's [Nicola] from Twitter, whereas if that was a cold call I wouldn't get the recommended reading and so that saves me work and so I can really maximise my network, I've got to the point where I can really maximise the network and it pays dividends for my day to day work." - Nicola

> "I would say that a lot of my Twitter network has been built on people I know, certainly at its core, its centre. However, I can connect with people on Twitter about a topic who I would never have otherwise met or interacted with, whether those are senior people like [examples] […] I can interact with [them] which I could not have done otherwise so it's been amazing for building connections with people whose work I might read, and another thing about Twitter, I think it's part of its logic is to make connections with people you don't know, sort of like thin connections you know. […] I made a tweet like this, and then [well known blogger on specialist subject] tweeted me back, we started this little conversation and I'm like come and speak to my students about your experience, it'd be really interesting, and she did, so yeah there's some like kind of cool things that can happen through Twitter I think, more so than Facebook or, I'm sure it could happen via Academia.edu, I've made connections as well, but it seems almost easier on Twitter than it does in other social media sites." - Rachael

> "I think the thing that I've always valued about Twitter is that it's a very good way of keeping your ear to the ground about things, whether its conferences coming up, potential government consultations, small pots of research funding, wider funding calls, finding out who's publishing what and where, and keeping those connections where if you've met somebody at a conference, presented on a panel with them or gone for a coffee or beer with them, you've kind of got a connection […] you might want someone to review something or be an external examiner for you, so it's a really simple and effective way of engaging with those who are engaged." - Quentin

The characteristics of network structures observed on Twitter suggest that this platform may offer more potential for novel connections and opportunities for

academics, which would help explain why it is a better platform for generating social capital. The less formalised connections may make it easier to establish connections with others who are not already known to academics 'offline' and more diffuse network structure may allow better circulation of information (Parise, Whelan & Todd, 2015). The interviews allowed the network structures to be examined in these terms. By discussing the community structures with participants, academic affiliations and research specialisms define communities, while institutional affiliations are less frequently present in Twitter communities, which align with research topics and personal interests. The types of brokerage role performed by ego (that is, how the participant is positioned in relation to the communities they are linked to; see Section 6.3.4) is contrasted on different sites, with academics most frequently being 'representatives' on academic SNS, and 'liaisons' on Twitter. Representatives mediate flow of information out of a community, while being in liaison-type positions mean that academics on Twitter are mediating the flow of information between communities which she is not strongly integrated into herself (Prell, 2012).

Together, the network structures and co-interpretive interviews support the idea that network structures on academic SNS are more hierarchical, based on existing connections and affiliations, and are more aligned with outward transmission of information; while Twitter networks are larger, more diffuse, defining communities in relation to interests rather than institutions, and facilitating novel connections and information gathering.

8.2 How do academics construct and understand their ego-networks?

Gaining an insight into how academics construct and understand their ego-networks was primarily addressed through the co-interpretive interviews and discussions around the interactive network structures. The process of coding the interview data has been described in detail in Chapter 4; the finalised coding scheme was introduced in Section 7.13.2. The three themes in the coding scheme follow the process of describing the phenomenon (in this case, the network structures); explaining the phenomenon; and making links between the explanation and their roles as academics.

In summary:

- There are differences in network structure on different platforms, based on who and how academics choose to connect to others.
- The differences in structure reflect differences in how academics use the sites and conceptualise their role.
- Reasons for using the sites in these ways are strategic and linked to their relationship with formal academia.

Each level will be discussed in relation to RQ2 and the wider literature, drawing upon illustrative quotes from the interviews.

8.2.1 Differences in network structure on different platforms

The interviews offered the opportunity to understand the structures from the participants' viewpoints. This confirmed the suggestion, from the trends in network structure (Section 8.1), that academic SNS largely replicate existing professional relationships. A consistent exception to pre-existing relationships as connections on academic SNS was found in links to leaders in their field and role models, although the expectation of the relationship was to keep up with their work, rather than forging a social connection.

> "on ResearchGate I follow people who I've never met, but whose research I admire. […] I don't follow people with the expectation that they will follow me back, it would be more that they're likely to publish something that I'm interested in, and I'd rather know about it as soon as it came out"- Frances

> "On the whole they [ResearchGate connections] *will largely be people I have existing relationships with*, I mean there are people on here *who I've never met but whose work I find interesting*, that's why I follow them, this guy down here for example [admires work] […] but a lot of them I do have existing relationships with." - Lucy

The finding that academic SNS largely replicate existing working relationships resonates with conceptualisations of self through SNS as 'public displays of connection' (Donath & boyd, 2004) or 'relational self-portraits' (Hogan & Wellman, 2014). However, in contrast to these concepts, the interviews place strong emphasis on existing relationships as connections rather than imagining a future academic self. This recasts their role a 'relational CV', with implications for how users interact with network structures on academic SNS, and how academic SNS may usefully use network structures to enhance the experiences of using the sites for academics (network structure not being exploited by the sites at present).

In contrast, Twitter both reinforces existing professional relationships and fosters novel connections. This is often linked to a perception that connections from in-person events may be pre-empted or reified by connecting via Twitter, or that

Twitter provides a space akin to social events at conferences, creating connections that will then be drawn upon when the academics do meet in person (Section 8.2.2).

> [Twitter] "I think I better maintain this network, and kind of actively look for people or organizations that are of interest to me, not just in a professional context but also personally […] I can't say I really go on to Academia.edu much and kind of look for people in particular areas or use it very much as a network at all. I probably go on there and update if I've got a paper or something that's coming out […] whereas Twitter I'm using virtually every day, so that's probably why there's less connections between people in a sense that the other one is more departmental or more organisational, whereas this is like 'ooh ok, so these guys look like they're doing some interesting things' or met somebody at a conference." - Carol

> "I know correlation doesn't equal causality but it was being in the right places at the right time and I found that being at the relevant conferences where those people are and also having that connection on Twitter as I said just nailed that first contact that people might recognise you from your profile and then there is a connection there, you are interested in them and interesting to them so I think it kind of goes hand in hand with some other things, and I've kind of got lots and lots of, you almost kind of have a friendship before you get to events sometimes because you've exchanged opinions or resources on Twitter and then you go to a conference and you've almost got a ready made friendship in a way. It's quite interesting and quite pleasant." - Quentin

> "You do find people on Twitter and then you might meet them at a conference and then it's oh it's that Twitter person, and yeah my [conference] presentation this year was a collaboration with someone that I did meet through Twitter first, and I guess a lot of the [institution] people that I meet at the conferences I've known them on Twitter first and we've formed ideas, I wouldn't say it's been anything big, just, you know, if I want to do a piece of work I just see who's on Twitter, who might be up for that. It doesn't maybe give you the big opportunities but it's a group of people there now that I might put ideas to, we do work virtually together." - Marilyn

In comparison to her ResearchGate network, Lucy would "definitely" be more likely to follow people she did not know already on Twitter, "if other people have tweeted something interesting that they've tweeted, or if they followed me." She is sceptical of the potential for tweets to build meaningful novel collaborations and does not heavily use the site but gives an example of a blog network she was recently invited to join:

> "I don't think any specific research collaborations have sprung up. I should also say I tend not to be very interactive on Twitter, I don't really initiate discussions, I will tend to respond if somebody directly interacts with me but I find it quite difficult to interact in that way on Twitter just 'cos it's so difficult to say anything meaningful in 140 characters, so I see it as much more useful as a way of receiving and disseminating information, interesting new stuff that's been published, which may hinder the ability to start up new research collaborations. I also just find it so time consuming to try to write anything meaningful in 140 characters, I don't see it as a particularly good way of interacting with my colleagues because I find it too time consuming. Having said that, I suspect, I've recently been asked to join a blog network,

> and I suspect that invitation probably came through my Twitter activity. If I recall I think there was a particular paper of mine that I tweeted that was picked up by someone who's I think he's one of the organisers of this blog network, and I don't know that for certain at all, but I suspect that invitation to join this blog network, Twitter may have been responsible for it." - Lucy

The value of Twitter as a way of building collaborative relationships when combined with nascent academic material in blogs also tallies with Kieran's experiences:

> "There was a blog post that I wrote on the Anthropocene a few years ago which I tweeted and which got a bit of traffic going around it, and my partner also wrote a piece on the same topic on our blog, and that did the rounds as well, and we were approached by some people at the [overseas institute] and started talking about this concept and what it means and found we had some common ideas and decided to try and write a paper, and this sort of rumbled along for about a year, and the guy who instigated it all had a baby in that time and couldn't really do a lot for it and nobody else wanted to take the lead on it so it just kind of fizzled out, which was a bit of a shame but that yeah, even though it didn't come to anything, that was a pretty kind of concrete bit of causation between a Twitter conversation and a traditional academic exercise, even though it failed ultimately. It didn't fail because of its origins, it failed for other reasons."- Kieran

In relation to Twitter, the blurring of its use in combination with blogs and conferences may relate to its value in making novel connections. These findings support recent results from Dermentzi, Papagiannidis, Osorio Toro and Yannopoulou (2016), who used structural equation modelling to explore academics' reasons for adopting academic SNS and other online platforms. They conclude:

> Differences were observed between the model of SNS and the model of online technologies, indicating that academics consider using SNS for different reasons and in different ways than the rest of online technologies. While academics' attitude and perceived behavioural control are the main drivers of their intentions in both cases, social norms play an important role only in the case of online technologies. Academics seem to consider SNS more suitable for networking (either for creating new contacts or connecting with the old ones) and maintaining a professional image in the academic

> community and the rest of online technologies for making new acquaintances in their research area and seeking academic information. (Dermentzi et al., 2016, p. 330).

These results allude to being rooted in differences in terms of how academics conceptualise the different platforms. The present study builds upon these findings and those of Dermentzi et al. (2016) by exploring network structures and their creation with participants themselves, which will be introduced in the next section.

8.2.2 Differences in network structure reflect differences in how academics use each site and conceptualise their role

The differences in structure reflect differences in how academics use the sites and conceptualise their role. The interviews confirm and explore the high agreement reported for the item '*I see my profile as an online business card*' in the online survey (Section 5.2.1). Academic SNS are viewed primarily as a formal academic identity, encapsulated by metaphors of a repository or business card. In contrast, a mix of professional and personal underpins conceptualisations of Twitter, being akin to a conference coffee break. In exploring these differences, this section makes links to how academic identity is inflected through the lens of online platforms.

In the interviews, description of the network structures observed by the participants were typically attributed to how they use and think about each site. To recap, the structures of ego-networks on academic SNS (Academia.edu or ResearchGate) were smaller, and more highly clustered around communities which related to the academics' previous work experience and institutional affiliations. Metaphors for academic SNS conceptualise the sites as either a virtual

CV, or personal repository, or a combination of both roles. As such, academic SNS are viewed as 'static' and not sites which foreground social interaction. This confirms and elaborates upon Bukvova's (2012) characterisation of academic SNS being used mainly as 'visit card, curriculum vitae', or an online 'presence'. This perception is likely to be highly influenced by the design of the platform itself (Papacharissi, 2009), with the design of profile structure dictated by academic SNS reflecting expectations of content associated with academic CVs and how their conception of authentic academic identity has been written into the platforms (Kimmons, 2014).

> "I think you get a stronger sense of the person and their interests and their personality from Twitter, because Academia.edu is more static, it's a bit more po-faced, more serious, this is my best CV face, whereas Twitter, I'm quite careful, so on Twitter I use my maiden name at work, and Twitter is very much my professional account, so Twitter's my maiden name, whereas on Facebook I use my married name, and quite a few of these people I'm Facebook friends with too, but I talk about quite different things on different networks." - Pippa

> [ResearchGate] "I do try to maintain an up-to-date publication list, and use it for posting full-text versions of my work […] A CV in terms of a publication list, but I don't really have any other details on there that a CV would normally have, but in terms of a publication list, *that's basically how I see it, as a publication list, as a way of archiving publications and making them open access as well, and disseminating them to people within the network*." - Lucy

> [Academia.edu] "I don't really use it, apart from as a place to dump material." - Oliver

As Emily, Nicola and Quentin suggest below, having an online space in which to develop a specifically academic identity is viewed as being particularly important for ECRs, giving them a place to develop their formal academic identity online, in relation to seeking jobs (differences which emerged in relation to job position will be discussed further in Section 8.3.2).

> [Academia.edu] "I just felt like about it being static [like it was a business card] and I just felt like all the pertinent details are there as a business card, particular while I was on the job market […] because I was temporary I certainly wasn't getting much more than my name and photo on the website, no research portal or anything because I was just teaching staff, so Academia was important then because at least if someone Googled me they would find me." - Nicola

> [Academia.edu] “I was kind of potentially applying for jobs and postdocs and things it was just a case of getting that content in a good enough shape in terms of showing a breadth of things that I was doing in case somebody was Googling me or that kind of thing, so I did use it that kind of soft way, not a hard CV […] and kind of links out to some of the things that I was using a bit more, so kind of my work profile, wherever I was, whether I was at [Institutions] so it’s sort of updating those links so there’s enough information there that links out to the main content.”- Quentin

> “Having a profile on Google Scholar or being on Academia.edu is kind of like this is my serious profile, *this is your academic CV, it’s you big, long-form academic CV*, whereas being on Twitter kind of says that you’re more interested in public communication full stop, you’re interested in how ideas get out there, what’s going on.” - Emily

A complementary metaphor emerged describing Twitter as being akin to social break times, such as cigarette breaks at work or coffee breaks at conferences. The metaphor of coffee break has also been utilised recently in relation to academics’ use of Twitter (Ahmad Kharman Shah, 2015). Ahmad Kharman Shah (2015) describes the process of how academics fit their Twitter use into their daily routine, put into practice as micro-sessions, integrating small Twitter sessions into their day in a similar sense to coffee breaks. In contrast, here, the metaphor of coffee break did not surface in temporal terms, but rather, social terms, which is perhaps an additional novel contribution of using a network-focused approach. In the present study, the role of Twitter in terms of a coffee break in the social sense has also been touched upon already in relation to building bonding social capital (Section 8.1), and priming latent connections ahead of face-to-face meetings at conferences (Section 8.2.1).

Harriet described Twitter in these terms, alluding to its role in bonding social capital with pre-existing connections:

> "All of a sudden it really took off as a professional thing, and that was kind of really interesting to be there before it happened in a way, and to watch that, because there were a few of us say from [university A] who'd been on it for a long time, and it was kind of like you know the people who go outside and smoke and talk about everybody else, it was a little bit like that, that you were 'in', and I still know those people better even though I might not work with them or have anything to do with them, *I still know them better and feel differently about them because we were Twitter friends*, before everybody else was. […] But it's a really nice way of building social interactions with people I see all the time, like one of my colleagues, she's just got a new puppy, and I wouldn't know that if it wasn't for Twitter, and then we can make some jokes about it and then when I see her she'll tell me how the puppy is, and then we just talk about work, and I just really like that, *I like the way that it kind of gives you a way to separate out work, but not to ignore the fact that people are human beings, so they get to exist in their roundness, their totality, so that when you're doing work you can just do work stuff, but you can still appreciate them, like as whole people*." - Harriet

> "If you wouldn't say it in small talk at a conference, don't post it on Twitter." - Frances

> "I think that's why Twitter makes such a good academic networking opportunity, both for talking to other academics and people who aren't academics but you want to talk to and you want to be able to talk to you because you just run into them by accident, you just bump into them on the street, virtually and that's the way you meet people in real life, that's the way I would want to meet people. *In a way Twitter done right is like the social at the end of a conference, but permanently*, and if you do it right, it has all those benefits to it. Nobody feels like they have to talk to you, but they all feel like they quite fancy it, and *you end up chatting to really interesting people completely by accident that you never planned to, but in retrospect you wish that you had earlier, and that's why it works. It works because of that balance of accident, that balance of serendipity*." - Jacob

While academic SNS were described in purely professional terms, the merging of professional and personal creates a different environment for interactions on Twitter. Negotiating the divide between personal and professional can be seen as potentially problematic, but an expectation of some personal expression and authenticity is a defining part of Twitter to an extent.

> "I think the hard thing for Twitter is to get the tone because I think it's something less serious, but it's not Facebook […] but you should try to be a little more light-hearted when you can be, 'cos I think people like to have this kind of mix, that there's an element of a personal connection […] as a researcher people want something a little bit more than the only thing you ever say is 'here's my latest paper'. - Frances

> "I think it is definitely a mix. […] Twitter's a really interesting one, so I absolutely use it for professional purposes, probably more so than personal ones, but the nature of Twitter is kind of this weird mix, so generally, from what I understand, it's like it's personalised, right, so it involves being a little bit personal, if that makes sense." - Rachael

Striking the right balance between personal and professional is challenging and an issue which the academics in this study are highly aware of. Strategies involved in presenting an authentic, professional yet personal, academic are a mix of choosing which information to divulge, the language used to do so, and awareness of how different audiences will perceive the tweets.

> "I sort of enter into jokey conversations with people on Twitter, where there are levels of irony and sarcasm which you wouldn't use in an academic paper or something […] in that sense there is sort of different registers of tone and language and presentation which kind of straddle that boundary between the personal and professional, and there are sort of ways of policing that boundary that don't just exist at the edge of social media."- Kieran

> "one of the challenges that I've always found with Twitter is getting the balance right between the more personal, you know who I am, what I do without posting pictures of my dinner, that kind of stuff, and then the balance between being the credible academic that's interacting with the right thing, saying the right thing, being in the right place. So I've always found it hard to strike that balance and I think a lot of colleagues have a work account and a personal account but it would just take up too much time, and I think overall there's a lot of stuff about the notion of authenticity within tweeting, so I think I try and strike an OK kind of balance between personal content, friends and family, party political content that makes a point but hopefully doesn't annoy people [...] So I think that's the real challenge with the personal and the academic day job is again striking that balance." - Quentin

Several of the participants here discussed having considered or set up separate Twitter accounts for personal and professional identities (this was not perceived to be an issue for the exclusively professional academic SNS), although this practice often proved cumbersome and time consuming, and for the academics here at least, the professional identity would prevail but in combination with personal elements.

> "I joined Twitter, I made two accounts, I made a personal account and a professional account […] in the beginning I had two accounts, [name] and that was my personal account, and then one was [name] and that was my professional account, and I kept it like that for about 2.5 or so years and then I realised that actually that was a really bad name and I should change them over, so then I changed my professional account to be [name] and my personal account, it's locked and it's got a different handle and actually to be honest I very rarely use it and I've contemplated deleting it a few times because I don't use it."- Emily

Expectations of authenticity and negotiating the balance between mixing and dividing the personal and private on Twitter reflect its status as a type of 'networked publics' (boyd, 2008; boyd, 2011). Networked publics are "publics that

are restructured by network technologies" (boyd, 2011, p.39); boyd's seminal work on teenagers use of SNS (boyd, 2008) identifies three key concepts at play in SNS when viewed in this light: invisible audiences, collapsed contexts, and the blurring of public and private. The blurring of personal and professional in the context of Twitter is also supported by the findings of Ahmad Kharman Shah (2015); "Academics create a 'self-brand' by displaying their professional activities on Twitter, whilst at the same time showing their 'real-self' through revealing their human side." Although the empirical basis of these concepts contrasts with the study here (teenagers in the early web 2.0 era, compared to professionals across all career stages nearly a decade later), these dynamics are still at play.

Context collapse refers to the loss of context in SNS, whereby distinct social relationships are flattened into all being 'friends', and the jarring social interactions that occur as a result, which would not be an issue as those social circles would not interact offline (boyd, 2008; boyd, 2011). The concept of context collapse did not play a prominent role in academics' use of the sites. It was entirely absent from discussions about academic SNS, and while the majority of academics' demonstrated a high level of awareness of the potential for complications of this nature on Twitter, it was not experienced as a problem. A notable exception was found however in the case of Nicola (a lecturer), in an example which particularly demonstrates the collapse of academic hierarchy in having her students and academic peers in her Twitter network:

> "I was scolded recently at work for Twitter. I was grading BA dissertations in the spring and a student had just been careless with some typos and spell check and I just wrote 'this word should have been that word, and that word should have been this word, argh, #gradingdissertations' and a student who follows me identified the words in my tweet as coming from her dissertation, and she complained to my colleague and said that I was making her feel badly, and she didn't like that she could be identified by the tweet, and my colleague said to her 'there's no way that you could be identified by that tweet, there's no mention of you, it's just a mention of words, and you should be grateful to [Nicola] for the extra feedback on your work' […] but before coming to [overseas site] my head of school wanted a meeting, and she said 'I have to talk to you about ', so she actually called it Twitter-gate, and I thought 'oh my God!' and she's just like 'you can't tweet anything that could identify a group of students' and I thought 'really?' and I explained to her that I often use a hashtag to group students from a particular unit and she said 'no but you can't do that because students who aren't in that unit might be upset you know that students in that class got to do something and they didn't get to do it' and I was thinking 'seriously? like I can't say that the level 4 students did brilliant work in class today because the level 5 students might feel inadequate?' so that's just because of Twitter and I just thought this is really sad, and I never mentioned students names unless they know me and they know I'm doing it like I've taken their picture and they've said yes you can tweet that. I don't follow them and I don't mention them by name unless they OK it with me. *So that means I'm not going to be tweeting about teaching anymore*. The head of school made me agree, she was like 'the university doesn't have a social media policy', so yeah. And it annoys me because our Dean, the Dean of the faculty, regularly tweets things about students who have done good things, so I just think well it's easy to identify those students, and the rest of the faculty could feel awful for not having some accolade on them, but its ok for the Dean to tweet." - Nicola

Perception of potential risk was coupled with academics' describing a range of personal mechanisms they had developed to mitigate these risks, using criteria based on imagined audiences (e.g. whether a grandparent would react badly to the content) or not openly discussing particular topics (e.g. politics) (Chapter 7). Such mantras touch upon all three dynamics of context collapse, invisible audiences and blurring public and private (boyd, 2008), and also to processes of managing microcelebrity which sit at their intersection (Marwick, 2010). The phenomenon of microcelebrity examines the processes by which individuals tailor their content on SNS in response to perceived audiences (Marwick, 2010). For example, if Isaac had a new paper out, he would upload it to Academia.edu but not tweet about it; "I'm conscious of the fact that a lot of these people wouldn't be interested in it".

The blurring of public and private (boyd, 2008) was found to be strongly influential on how academics conceptualise their use of different sites, the networks they foster, and how their personal and professional identities are expressed via different sites. The distinction between personal and professional identities being modulated by different sites links to other work on academic identity online. Expression of professional identity online and its necessity to be tied to an authentic name contrasts with influential early work on digital identity, which emphasises identity construction, anonymity and pseudonymity (e.g. Turkle, 1996). While generic SNS platforms (such as Facebook) have enacted 'real name' encouraging policies in recent years (Ellison, 2013), expressing professional identity online arguably necessitates a singular (or at least primary), recognisable identity, to accrue professional reputation. These issues may go hand in hand, but as Kimmons (2014) argues, the concept of what constitutes an authentic identity varies according to different platforms, and digital literacies are required in order to prevent identity being prescribed entirely by the platform.

In relation to how academic professional identity is expressed in different terms through different SNS, Veletsianos and Kimmons (2014) coined the term 'acceptable identity fragments' (AIFs) to describe the multiple ways that trainee educators express their personal and formative professional identities through SNS, "as a constellation of interconnected fragments" (Veletsianos & Kimmons, 2014, p.295). Veletsianos further argues that AIFs contrast with Goffman's dramaturgical approach to identity, AIFs represent not a performance but a "revealing" of parts of identity that "were always only facets of self rather than any more overarching sense of self" (Veletsianos, 2016, p.97).

The interviews here both confirm and challenge some parts of the existing conception of academic identity as AIFs (Veletsianos, 2016; Veletsianos & Kimmons, 2014). The performative aspects already discussed – of considering audiences and managing identity in a similar manner to microcelebrity (Marwick, 2010), particularly in relation to Twitter, suggest that the dramaturgical approach should not be discounted entirely. The interviews here provide evidence that different aspects of academics' identities are divulged on different sites, and elaborates on the relationship between identity and different sites, which are perhaps not so independent of one another.

> "My personal Twitter account, I imagine that part of the grey nodes there will be a number related to personal interests of mine […] whereas if you see my Academia.edu won't reflect that because it's not, it doesn't reflect that part of who I am." - Carol

The interviews here support the notion that different sites support different AIFs, and that AIFs are not entirely discrete but can have overlapping audiences. In doing so, the present study validates Veletsianos and Kimmons's (2014) findings with academics from a wider range of jobs and disciplinary traditions than their original sample. It also provides clearer definition of the 'types' of identity – in terms of both role and audience – that may be associated with different AIFs. In contrast, the data here suggest that rather than being a fragmented constellation, academic professional identity online is perhaps better thought of as being part of a spectrum from personal to professional, and that different sites occupy different segments of the spectrum. This also builds upon Kieslinger's (2015) assertion that academics' online identity management polarises around personal and professional audiences.

The online academic personas described by Barbour and Marshall (2012), introduced in Chapter 2, draw primarily from examples based on academics' use

of blogging, also align broadly with a spectrum between personal and professional identities and being mediated by platforms. However, the data here would suggest that a single academic may not be adequately represented by a single persona; different personae may be reflected in different sites, to an extent. For example, the 'formal self' is characterised by one-way broadcast of short, very controlled biography and publications and a lack of interactivity, which particularly resonates with the use of academic SNS platforms here. In contrast, the 'comprehensive self' reflects the blurring of personal and professional seen as part of the logic of Twitter. A further persona, the networked self, emphasises interactivity, links between academics' own persona across different social media platforms, and to colleagues. The data here would suggest that academics enact different personae on different sites, which is supported by Esposito's (2015) weaving and splitting of identities across different platforms in her study of doctoral students.

Online academic identity as a spectrum between personal and professional is evidenced in the interviews here by the contrasting roles of academic SNS and Twitter, and also extending when participants drew upon their use of Facebook or LinkedIn to illustrate their points. An emergent model of the personal-professional spectrum, as enacted through different sites and for different audiences based on the interviews here, is shown in Figure 8.2.2.1.

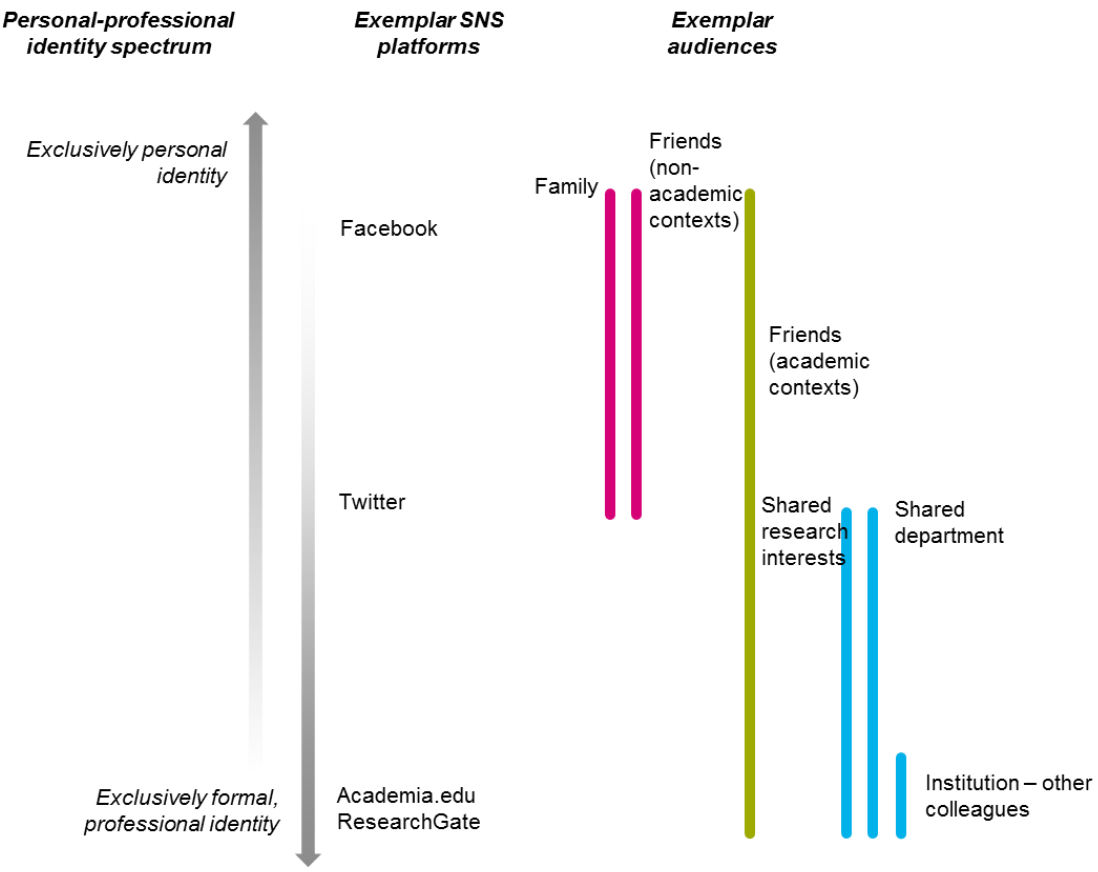


Figure 8.2.2.1: Emergent academic personal-professional online identity spectrum.

Academic SNS represent the primarily professional end of the spectrum; when LinkedIn was referred to, it was aligned in a similar way, albeit with a not exclusively academic audience. Twitter was persistently described as a mix of both personal and professional, as discussed earlier.

Facebook was consistently presented as a primarily personal space, albeit permeable; even those (such as Alice, for example) who were adamant that it was not part of their professional role or identity acknowledged that they did connect with former colleagues and discuss being an academic to an extent on the platform. Even amongst Facebook use as a personal space, such overlaps between audiences existed. Participants who were the most reserved about expressing the personal online did not silo their personal identity into one platform

such as Facebook, but made a broader decision to not post what they considered to be exclusively personal on any platforms (such as Jacob). Defining and choosing what not to post (on any platforms) was also identified by Kieslinger (2015).

> I see [Facebook] as the flip to Twitter, so Twitter's more professional with a bit of personal slipped in, I think I see Facebook as entirely personal but I do have students, I do link to some professional groups, but id students friend me I'm you know in class I make it quite clear that this is our personal time and personal space, and I might occasionally have a glass of wine and swear, so there's a bit of disclaimer that goes with Facebook." - Marilyn

The idea of fragments of academic identity online being aligned with a spectrum between personal and professional is also supported by a recent study of Masters students use of social media (Josefsson, Hrastinski, Pargman & Pargman, 2015). While Josefsson et al. set out to examine the divide between personal and private uses, they uncovered the third, professional, role. It is notable that their study focused upon Masters students, as the emergence of the professional role reflects the finding that aspiring academics are perceived to be developing their online identities earlier in their careers (Section 8.2.3). There is a question of whether it is roles or profiles that define the unit of AIFs, and the relationship between formal academic identity, AIFs and roles. The next section will consider how the interviews elaborated upon the working relationship between formal academia and online networks.

8.2.3 Strategies of network use and their relationship with formal roles and academia

Having established that the network structures on different platforms are linked to the ways in which academics conceptualise the different sites, the third theme explores the connections between using the sites in these ways and the participants' formal roles as academics. Topics contributing to the theme include: circumventing institutional constraints; extending academic space; finding a niche; promotion and impact; and academic freedom. The topics build upon and incorporate the themes in academics' use of Twitter (Ahmad Kharman Shah, 2015; see Section 2.6) and the purposes for which academics use academic SNS and Twitter identified by the Nature survey (Van Noorden, 2014). The strategic themes identified here present a level of abstraction above these individual practices as to why academics use online networks in the ways that they do.

These topics bridge the gap between academics' online networks and their formal academic roles. As such, they provide a strong empirical contribution to understanding how digital scholarship (Weller, 2011) or networked participatory scholarship (the latter emphasis the role of online social networks in relation to digital scholarly practices; Stewart, 2015a; Veletsianos, 2016) is being enacted in practice and how online networks may be redefining roles and relationships with academia. This section therefore provides the link between the three RQs to the over-arching thesis (Chapter 1). Existing studies have examined ways in which social media and SNS may be at odds with formal institutional structures, such as not aligning with traditional indicators of academic worth and career progression (Gruzd, Staves & Wilk, 2011) or the risks of challenging power dynamics and structures (Stewart, 2015c). The themes here bring a different perspective to this

narrative, focusing on the strategic ways that academics use the sites and networks in relation to their formal roles. Being related to formal academic roles and the institution, the results also suggest that different strategies may be more important at different career stages; this will be discussed in further detail in Section 8.3.

The topic of **circumventing institutional constraints** is directly related to the formal institution with which academics are affiliated. Use of the online networks in this sense illustrates a strategic use of the tools to cultivate an online academic profile independent of controls on institutional web pages or repositories. This topic relates particularly to use of academic SNS (Academia.edu or ResearchGate), rather than Twitter. Harriet and Marilyn have webpages at their respective institutions, but there are restrictions on how freely this can be edited.

> "We have quite strict rules about what we're allowed to have on our departmental websites, which I totally understand even though *I find them a bit frustrating, and so I periodically do and don't have editing rights over my [university A] page*, so I use my Academia.edu page as the place where my publications are available if somebody wants to find them, and I don't really use it in order to interact with people, it's much more *if you want me this is where I am* […] I think over time, if the [university A] institutional repository becomes completely comprehensive, then Academia[.edu] won't have that function anymore, but in a way it always will because of the things which aren't published academic papers, like the conference papers or any little things that you could put up there, so that's sort of how I came to it and most of how I still use it." - Harriet

> "They do have an institutional profile, there's something that links from your Microsoft Outlook, your email, that links online that also then links to the research repository, so if you put papers on, it will come up on your institutional profile page so you can write a bit of text, you can put a photograph on, *but you can't put a URL in so they wouldn't let me link to my blog, so it's very limited, it's very restricted in how creative you can be in that space which is a bit annoying, but yeah they do encourage you to have an online profile, in a very sort of measured and controlled way*." - Marilyn

For Lucy and Nicola, their respective institutions are keen to populate their repository, but uploading is via a gatekeeper. Academic SNS therefore have advantages in terms of speed, and being perceived to be under their own control.

> "It's not ideal but I'm currently in the process at [University A] of getting all my stuff on to [University A]'s research portal which is so clunky […] and its you look at the academics across the university and its so arbitrary, some people have every single conference paper ever, some people have no activity, so *because uni repositories can be so useless, I think Academia[.edu] can be valuable in that sense* because no-one's going and checking to see if you really are allowed to have that article PDF online, so I think I use it for that as well." - Nicola

Extending academic space relates to ways of using online networks to develop or maintain a profile as an academic beyond the boundaries (conceptually or physically) of their current role. Marilyn and Rachael highlight their use of Twitter particularly in order to maintain research agendas and connections which are not a formal part of teaching dominated roles:

> "*I see them [institutional role and online activities] as totally separate*. We don't have a social media policy here. We don't teach these literacies to our staff and students. There's no open educational activity here, so actually it's a very distinct line for me, *about what I sit at my desk and do and then what I go home and do*." - Marilyn

> "In terms of my academic identity, I came to be an intellectual at [University B], I worked at [University B] for six years as a fellow so I was a PhD student but I was also a faculty member, and so I felt very heavily connected to [University B]. [University A], although I'm a lecturer, I'm also a parent and yeah so I feel like, I feel like in terms of [University A], *my online identity is actually quite distinct from my role at [University A]*, and I do have obviously institutional affiliations but they're […] [University B] is a research-intensive university that's a leader in its field, whereas [University A] is not even part of the REF [laughs]. So they're completely different institutional identities and affiliations so there are many fewer ways at [University A] to be able to participate publicly, whereas at [University B] there were ample opportunities for that, so yeah, to answer your question, my online identity is quite distinct […] I feel like my online identity is more integrated with [University B]."- Rachael

Twitter has proved to be an effective way of maintaining a connection to her professional role as way of overcoming barriers in terms of time and physical location, in relation to maternity leave and the geographical location of her institution:

> "I [started using Twitter in] 2012 because I had my second stint of maternity leave and *Twitter was amazing for feeling like I was still part of something and not missing out when I couldn't be out and about*, I really valued it for that, and I think it's really powerful for women to be active in things because although we shouldn't be sexist about it, women get tied down with childcare more than men and much less physically mobile, it's more difficult and *Twitter is incredibly valuable for keeping a part of a conversation*, I mean also *I find [Institution] geographically quite remote, so there's all sorts of things going on in London that I feel I know about because of Twitter*. Also I'm part time at work at the moment because of having small children, so *I feel slightly disconnected from my home university, and Twitter is a semi-substitute for that*. There's sort of meetings and training that I don't go to at work, but I sort of have a sense of stuff that's going on out there in the higher education world, from Twitter." - Pippa

This theme also includes examples where academics have used online networks (particularly Twitter) in order to create multiple online identities, representing not only their personal identity (see Section 8.2.2), but those of their projects, groups and departments. Isaac couldn't put an exact figure on the number of Twitter IDs he has; "I don't know – maybe two dozen!". These include accounts related to personal interests, to make satirical political statements, and academic project accounts. Carol, David and Oliver also highlight accounts which they manage or co-manage for academic projects they work or have worked on.

> "I should say that I also have project Twitter accounts, so if I want to promote something via a project-specific Twitter account I'd use that, but I only tend to look at my own, I'd only go to the project ones for specific [inaudible]." - Oliver

David uses Tweetdeck to manage several professional accounts and streams which he is responsible for. He also runs his department's Twitter feed; his research group also has a Twitter account, and he helps run the Twitter account for a specialist research group he is part of associated with the Royal Geographical Society. The departmental account is particularly important:

> "there's a lot of my department that are on Twitter, so a lot of the work of maintaining that account is retweeting, but then you have to be on top of the press releases and making sure that you're tweeting about those, trying to tweet blog posts that might be associated with particular research projects, retweeting messages from departmental or university-level research groups that are relevant, so it's a dissemination exercise, it's not a conversation especially, and we certainly don't do any kind of student triage, 'cos I don't have the time." - David

The ‘extending academic space’ theme also includes emerging practices around Twitter as a research site in itself. For example, Emily joined Twitter in 2011, as part of her doctoral research, to discover links to individuals and blogs related to those who doubt the existence of a particular phenomenon, an otherwise hard to reach population. While this has been an integral part of Emily’s doctoral work, other participants also view Twitter as a research site but in less formal terms. For example, Nicola uses Twitter to monitor developments in the industry related to her research topic, and Pippa has used Twitter to monitor world events in real time, and crowdsourced photos for her book. Kieran also follows a population which is highly sceptical of his research topic, but maintains a distance:

> “I was studying [PhD research topic] and so much stuff plays out on Twitter, it also was a sort of a field for me if you like, a space to, not research systematically but just a space to observe some of the [topic] happening. So yeah there was kind of an empirical justification for it as well, in that you know a lot of prominent [scientists] and [sceptics] are on there slugging it out everyday, and I thought, if I’m going to get my head round any of this I need to be party to at least some of that stuff. I never really waded in to any of that, just because I, partly I just imagine it would suck you in and kind of consume all of your energy, and also it’s the willingness to be a detached observer of these dynamics rather than getting your hands too dirty. […] So I kind of follow those discussions when they happen, but I don’t intervene in them and try and sort of, I guess, over time I’ve sort of limited my direct interactions to people who are doing similar research rather than interacting with people who you might say are my research subjects, if you like.” - Kieran

The idea of online networking sites playing an important role in constructing an academic identity came through very strongly, with notions of **finding a niche** being viewed as particularly important for doctoral students by academics at all levels (see also Section 8.3).

> “In my previous research area it [Twitter] was definitely more prevalent among younger [ECR] researchers.” - Gillian

Now PhD students, Isaac and Jacob both started to cultivate their online identities, with a view to a future career in academia, during Masters courses.

> "I started using it because […] I just thought it would be interesting, finding out what other academics were doing, sharing my work a bit, 'cos when I started the MRes that was when I started thinking about what research I really wanted to do, and where I wanted to place myself as an academic. So part of that process is sort of identifying your niche, and letting people know that you're there, so I figured it might be useful for that." - Jacob

> "I think that just in general I like to be across what's happening on particular parts of the Internet, and I also figured that because I am looking towards an academic career that it would be a useful tool to have further down the line to subscribe to academics and eventually put my own stuff up there." - Isaac

Reflecting on when they set up their academic SNS and Twitter profiles, Kieran and Quentin (now a postdoctoral researcher and lecturer, respectively) also note that these activities were undertaken when they were still students, in a similar spirit. Quentin also notes that he perceives that the need to form an online academic identity has shifted to earlier in the career trajectory, based on increasing numbers of undergraduates creating profiles.

> [Why did Quentin start using Academia.edu?] "Mainly it's that kind of doing a PhD, trying to get that early stage network of people that you know or should know, and also seeing a lot of the kind of grey content of literature and the papers that are coming through 'cos when you're thinking about putting papers out you kind of want to know what's coming through as well as what's out there, and I think a lot of younger academics in particular were using it to bounce ideas off each other or as a place to put conference papers. […] I've found there's an increasing trend on Academia.edu of kind of people doing undergraduate degrees and Masters degrees are using it, I think quite a lot of students they get to university, they get an Academia.edu profile and they look up people from the same institution, lecturers or researchers, and they just kind of build their own connections that way so it's quite interesting that it seems to have shifted further back along the career path and education, and more and more people are using it to get those very early connections, maybe even something about how proactive and forward-thinking our students are compared with probably how I was when I was an undergraduate." - Quentin

Emily described her Academia.edu account as a 'portable repository' (Section 8.2.1), emphasising its role as a space which is defined but can travel with her. Although Emily does not intend to stay in academia after she finishes her PhD, she is likely to keep using Twitter because she has created 'a personal brand' there, although this may be modulated depending on her employer (see also 'academic freedom'):

> "It's so funny, I was just thinking about this. I do, because and this sounds really pretentious, it's your personal brand, you are, it's a very public way of saying these are the things I'm interested in and this is my perspective on them. You can tell very clearly the politics of someone if they use it in that way, and I think it really depends on where I work, what their policies are. So I see lots of people whose accounts say 'this is my personal opinion, I work here but this is definitely my personal opinion' and I, because I only really started using it in an independent academic context, I haven't had to do that, but especially if I was working for a government department, I would absolutely be thinking a lot more about, you know I wouldn't send tweets criticising the government that I was working for overtly."- Emily

Post-doctorate, academic online networking takes a different role in negotiating interdisciplinary fields and transitions. For example, Carol's move from Philosophy to Education in the transition between PhD student and postdoctoral researcher is reflected in her network structures, through her high ego betweenness centrality indicating that she is acting as a broker between otherwise disparate communities. The transition is still an active process:

> "What I'm trying to do is find ways in which I can use Philosophy in my current job context, working [in Education]. I did a lot of work around play as part of my thesis, which is also what a lot of the people relate to in my network to do with the philosophy of play, so there's a crossover with stuff that I do here in relation to authenticity. I'm still trying to work out exactly how those kind of intersect, and my thesis was also very much concerned with Marxism and social equality […] so obviously there's a crossover of connections between that and what I do in connection with [current work], so in a way I'm kind of looking at ways of bringing those together, but I'm kind of working that out". - Carol

While he remains in his home discipline of Geography, Kieran is looking to find different ways of focusing his work, for example through engaging with STS, and this is reflected in his Academia.edu network:

> "I think that probably most of the people in the grey area at least I knew in some capacity before I followed them, and then these kind of [specialist research topic] people at the top are people that I kind of know of, but want to know more, so they're quite significant to then sort of follow them, 'cos that's the field that I'm sort of moving towards a little bit." - Kieran

Postdoctoral researchers are still liminal in relation to formal academic structures. For Nicola, Academia.edu has continued to provide a space for her formal academic identity in this sense:

> "While I was on the job market I was, I had a temporary lecturing position for three years in the Netherlands and I was on the job market the whole time, and the uni didn't have a good

> website and because I was temporary I certainly wasn't getting much more than my name and photo on the website, no research portal or anything because I was just teaching staff, so Academia[.edu] was important then because at least if someone Googled me they would find me."- Nicola

Lucy, while a senior academic herself, uses an example to highlight the progression of network structure and connectivity with seniority, which is linked to finding a niche. In discussing her Academia.edu network (Figure 7.12.1), she highlights some of her former PhD students, and a postdoctoral researcher, integrated in the University D Anthropology community. She highlights a node in the green community – closely related but not part of the same network as the others – as a PhD student, and is surprised that the PhD student is not part of the purple community. Lucy is currently her doctoral supervisor; Lucy's own PhD supervisor is also present in the network. Lucy co-supervises the student along with another academic, who was also supervised by Lucy's own supervisor. Considering how well connected the PhD student, Lucy, and her doctoral supervisor are, Lucy agrees that the trend toward PhD students being more peripheral and more senior academics better integrated within their communities would likely account for this.

In relation to **promotion and impact**, the ability to track metrics adds to the appeal of academic SNS. This is linked to mechanisms for promotion and perceived demonstrations of the value of academic's work, such as the REF. The interviews suggest that this topic may be of particular concern for mid-career academics, looking to secure permanent or more senior positions (see also Section 8.3).

> [On Academia.edu] "It's quite a useful substitute to vanity searching, so I quite like getting to know how many people have looked at my profile and how many downloads there are, and I quite like to see which papers have been downloaded more than others. I probably check on it about once a week." - Frances

> [Uploading new publications to ResearchGate], "*to make myself searchable, REFable, that sort of thing*". – Gillian

> "But I still use [Academia.edu] because of the metrics, I mean I really like that it tells me about how people found my page, because I know if they found Academia[.edu] the chances are they're finding Twitter and articles and other things that might not even be on Academia[.edu], so I still look out for that, and an academic friend of mine who's in my network, let's look at her I'm just curious, not to toot my own horn but various people use me as their social media role model, so [follower], so she pointed out, she had looked at my Academia[.edu] profile and said 'well I'm nothing compared to you because you've had X-amount of visitors on Academia[.edu]' and I was like oh I did? So her comment made me go back and look more closely at the metrics being provided and I thought oh OK that is quite good, and let me start checking regularly you know, who's coming to my page, and I did get in Academia[.edu] give you a badge or something if you're in the top 5% so I've had that a few times but I just attribute that to being an early user of Academia[.edu], just that I've been there long enough that the numbers have grown." - Nicola

Promoting her work was a key motivation for Pippa in joining Academia.edu and Twitter, as she was in the process of writing a book and wanted to be able to promote it via her online networks. She also wanted to be able to use evidence from the platforms as part of a promotion case. On her use of Academia.edu:

> "I can't remember how I heard about it, but I wanted to use it as part of a promotion application. I wanted to be able to say look, this is where my work's read, and how interested people around the world are in my work, and then I've found the more general benefits of it […] finding out about other peoples' research, just getting notifications of things they're working on, and just a sense of who's out there. I also wanted to build it up because I was writing a book, and I wanted to be able to tell people about it when it was done." - Pippa

While academic SNS do readily provide metrics, whether academic SNS or Twitter are actually more effective at disseminating research and achieving impact is not clear. For example, Lucy and Jacob hold contrasting views on the value of Twitter in this respect, Jacob alluding to a possible disciplinary divide in opinion:

> "Anything I find interesting, so it's very often be papers, recently published papers that I find interesting, and I think other people might find interesting, or occasionally blogs, that kind of thing. I also do use it to tweet my own new research, but *I think Twitter is probably much less effective at disseminating my own research than ResearchGate and Academia.edu*, so mainly Twitter for me is just about the transmission of mainly professional information." - Lucy

> "In the Social Sciences it is as valuable, and really as desirable*, for a tweet to be read by a non-academic as it is to be read by an academic*, and in many cases it is more useful to me for it to be read by a non-academic […] so *if I'm on Academia[.edu] and I write something like that, it's like shouting into a cul-de-sac*, because everybody already knows what I think and they don't really care 'cos they're too busy with their own research and half of them disagree with me anyway. […] Whereas if I tweet about something and it is read by a youth worker, that could turn into a research site, or could turn into somebody really wanting a copy of a paper, or a way to get a group of young people to come along to a conference, that sort of thing on Twitter for the Social Sciences is fantastic and as much as I would love to talk to more academics, to be honest I talk to loads of academics anyway because it's my job, the opportunity to share my academic perspective and the capital I have as an academic, the knowledge that I've worked on, to be able to contribute that to other people's discussions is really brilliant, I mean it makes me really really deeply happy […] I feel like there's a purpose to being an academic when you can do that."- Jacob

The topic of **academic freedom** may explain the differences in network structures observed according to job position to an extent, with professors and PhD students having the largest Twitter networks (Section 8.2.1); differences according to job position will be discussed in further detail in Section 8.3.

At the transition from PhD student to postdoctoral researcher (either within or outside of academia), participants indicated a perceived reduction in freedom to network. For example, Beth remarked that while actively networking was viewed as being part of being a PhD student, she doesn't feel that freedom as a postdoctoral researcher working on another academic's project. Jacob has always used Twitter in a personal capacity as well as professional; however, starting a teaching post in his department alongside finishing his PhD has impacted his views on tweeting to an extent.

> "I mean I just chat shit [on Twitter] sometimes, I mean since I when back to do a PhD and since I've had more academic standing if you like, and *since I've felt myself in a position of responsibility, I've tried to be less weird,* at least before 6pm, and I enforce that as a rule on myself, assuming that's working hours. But I know a lot of people who have two accounts, a personal and a work account, or go one way or the other." - Jacob

While awareness of Twitter as a public space, attendant potential hazards and practices to decide what should or shouldn't be mentioned on the platform were referred to by the majority of participants, there were indications that more senior

academics may feel more at ease expressing opinions, being more integrated into their professional communities.

> "Yes, I mean you just have to be very aware that what you're saying is public, so just don't say something too stupid and certainly not offensive, anything that you write down is going to be public, so try not to write things when you're too emotional. *But that doesn't tend to happen in an academic situation*." - Oliver

> "I would also be a bit cautious about expressing a controversial opinion, but mostly because I don't want to end up in the middle of some Twitter nastiness. But *I doubt that that would ever happen because within my community it's just people who know me [pink community] […] if they don't know me, they'll know someone who has worked with me*." – Frances

In discussing the themes here, we have explored the link between online network structure and the how and why of academics' strategic use of the sites, which shaped the networks' creation. This advances research in this field in two main ways. First, by providing further empirical evidence of how digital scholarship is enacted in practice, through the particular technological lens of SNS (practices associated with academic SNS not having been examined by existing studies). Second, examining the reasons and strategies behind academics' use of SNS allows us to bridge the gap between their online identities and formal institutional roles.

Models of scholarship, and how they are being reconceived in light of digital technologies, were introduced in Chapter 1. Building on the concept of networked participatory scholarship (Veletsianos, 2016; Veletsianos & Kimmons, 2012) as a way of understanding how digital scholarship (Weller, 2011) is enacted in practice through online networks and shaped by techno-cultural factors, the themes here provide an empirical example of how the relationship between a particular type of online technology (SNS) is used strategically in relation to academics' own identity development and formal institutional roles. The theme of extending academic space resonates particularly with Stewart's (2015a) reconsideration of the model

of scholarly activities in light of online networking. Although Stewart's findings (ibid.) emphasise the role of individuals rather than institutions, the interviews here provide insight into how individual academics can leverage their online networks to their own niches, both as individual academics and embedded within an institutional academic system.

The themes also show some resonance with models of online academic identity to an extent. While theories of online identities have been discussed in Section 8.2.2 (with Veletsianos and Kimmons's 2014 'acceptable identity fragments' in relation to particularly academic identity), identity in the previous section was framed in terms of different aspects of an authentic identity which are revealed or hidden from different audiences. Here, the focus is turned from what and to whom parts of an academic identity are shown, to the reasons why, through the more active ways that identity is enacted through the platforms. In this sense, the themes here relate to more performative definitions of academic identity online.

It is also critical to note here that academic identity is also subject to its own theorisation, and can be conceptualised as a trajectory comprising three strands representing intellectual, networking and institutional strands (McAlpine & Akerlind, 2010). Little focus has been given so far to the relationship between academic identity-trajectory and academic online identity, a notable exception being Esposito (2015) in her PhD student-focused research. The present study expands upon this, to examine differences in the roles of online networks for academics across a range of career trajectories, which will be discussed in the next section.

8.3 Does the structure and/or role of the network differ in nature according to academic career trajectories?

In order to gain further insight into the relationship between online networks and academic practice, the study also sought to examine whether the structure and role of online networks differs according to different stages of an academic career trajectory. Existing work has focused primarily upon the benefits of online networking for doctoral students and ECRs (Chapter 2). As Fransman notes in her 2013 study of early career academics:

> ECRs are forced to juggle interests, values, assets, resources and lifestyle with pressures around authenticity, visibility, status, security, belonging, freedom/independence and support. In this way, the diverse and dynamic practices of ECRs often come into tension with the homogenising structures of institutions (which include/exclude and privilege certain practices over others). Online profiles can act both as liberating spaces in which complex identities might be renegotiated and reconciled, and/or as rigid standardizations which obscure the less conformist elements of identities. (Fransman, 2013, p.1).

The themes here resonate with these findings, and extend them through studying a larger and more diverse sample. Given the embeddedness of the more senior academics within professional subject communities and desire for academics to follow role models, it is important for the benefits to be examined across whole career trajectories. This will enable academics at any career stage to make better informed decisions about their adoption of social media and give ECRs and students a wider range of academic role models, and make further key connections within professional communities explicit.

In addition to raising awareness of the practical benefits of online networking to a wider range of academics, examining differences in the structure and role of academics' networks in relation to discipline and job position also provides an empirical contribution to theory in relation to digital scholarly practice (Weller, 2011), networked participatory scholarship (Veletsianos, 2016) and how online networks augment the strands of identity-trajectory within Higher Education (McAlpine & Akerlind, 2010).

Addressing the question of whether the structure and role of the network differs according to job position and discipline drew upon data from all stages of the study (survey; network analysis; and interviews). Whilst some differences in perceptions about online networking were found in relation to discipline in the online survey, clearer distinctions were evident throughout in relation to job position.

8.3.1 Disciplinary differences

Preference for different academic SNS was the principal difference which emerged in relation to discipline. Academia.edu enjoys a greater level of popularity within the Arts and Humanities; ResearchGate is more popular with Formal and Natural Sciences, while Social Sciences are present on both. This is a finding which was consistent across both the online survey, and the Nature survey (Section 5.3). While it is interesting that either Academia.edu or ResearchGate have come to be perceived as more appropriate by contrasting disciplines despite being ostensibly very similar platforms, this fragmentation of disciplines across academic SNS platforms will have a negative impact on the efficacy of either network, and inhibit cross-disciplinary networking.

Disciplinary differences in terms of how academics use and conceptualise their online networks were limited. Five of the 30 Likert scale items in the survey showed significant differences according to discipline, although there was no consistent pattern apparent in terms of the disciplines involved or items relating to a particular theme (Section 5.4.3).

In terms of network structure, disciplinary differences were only found in relation to one SNA metric. Reciprocity was found to be highest in networks of academics from the Arts and Humanities on both types of platform, to a statistically significant extent in the context of academic SNS (Section 6.4.3). However, the interviews did not provide clear evidence about why this would be the case. The interviews did uncover a disciplinary element in relation to the types of communities which academics become part of on different platforms. While communities are more frequently defined by institutional relationships on academic SNS, subject areas and specific research topics defined communities more frequently on Twitter (Section 7.13.1). The interviews support the notion of Twitter communities as being representative of the subject areas in which academics are embedded. This is an interesting finding as it mirrors differentiation of academics' identity between formal, hierarchy-preserving and institutional-focused identity on institutional homepages (Hyland, 2011), compared to personal webpages as a site for developing a disciplinary-focused online identity (Hyland, 2013). Academic SNS are in some ways analogous to institutional homepages, particularly for those in positions which do not afford them formal representation on the institutional website. While restricted editing rights have been shown in this study (Section 8.2.3) to be a key reason for academics to use academic SNS as a tool to develop

their online academic identity, the practices associated with constructing a formal academic profile have travelled with them.

> "I've been looking at developing other profiles on other sites and things like this *as ways of kind of having a profile for my academic publications and presentations and things like that* I mean obviously you've got the [University C] one, you've got the one on Academia.edu, you've got ResearchGate, you've got Google Scholar, there's loads of these kind of things." - Carol

> "I see [Academia.edu] as *my portable repository of my papers*, so whereas I have papers on my [institutional] page, this is the way that I can have papers that come with me no matter where I go, and so I either put links to the paper, but I try to put an author-accepted manuscript up so that people can read it." - Emily

In contrast, the 'extending academic space' theme touches upon the ways in which academics can use SNS (particularly Twitter) to maintain contact with research communities that they are no longer formally part of, having moved to different institutions or taken primarily teaching roles.

The lack of clear divisions along disciplinary lines may support the idea that digital scholarly practices represent a new academic paradigm and open practitioners have more in common with each other than their 'home' discipline (Weller, 2014).

8.3.2 Job position

Sampling was informed by the concept of identity-trajectory to include a range of disciplines and job positions, as research suggests that the nature of being an academic is subject to differing strands at differing stages of a career trajectory (McAlpine & Akerlind, 2010, p.139-143):

- Intellectual strand: "represents the contribution an individual has made and is making to a chosen intellectual field through scholarship"
- Networking strand: "represents the range of local, national and international networks an individual has been and is connected with"

- Institutional strand: “represents each person’s relationships, responsibilities and resources wherever they are physically located”.

Across the different data sources used in this mixed-methods study, results consistently indicated that there are differences in how online networks are used and conceptualised at different career stages. This illuminates how the three strands of identity-trajectory (McAlpine & Akerlind, 2010) are reflected in academics’ professional use of social media, and extends and complements frameworks of social media use which have focused upon PhD students and ECRs (Esposito, 2014). The data will be discussed here in relation to each job position category included in the study: PhD students, researchers, lecturers, and professors.

The network structures of PhD students showed interesting differences according to platform. While their average network size on academic SNS was the smallest compared to other groups, doctoral students have larger networks than mid-career academics (researchers or lecturers) on Twitter. Given the finding more broadly that communities within academic SNS networks are mainly defined by institutions, it follows that PhD students would have smaller networks, as they are more likely to have worked at fewer institutions. This may indicate that Twitter provides a more ready space for students to create online professional networks than academic SNS, although it is a finding which is contradicted by a recent study by Veletsianos and Kimmons (2016).

The contradiction is intriguing; postgraduate students were found to have substantially smaller networks (average size 36) than lecturers or professors (average size 557). The disparity is likely to relate to the different approaches to

sampling which were used in the studies, and possible explanations would warrant further research. In the present study, participants were recruited on an opt-in basis from three disciplines and being located within the UK; Veletsianos and Kimmons (2016) sampled based on who had tweeted in relation to a particular conference (AERA 2014), so reflects one particular subject area, did not require opt-in, and may be biased towards those physically located within the United States (and/or who could afford to attend the conference). The sampling strategy used in the present study is more likely to have attracted academic Twitter users who use the platform more actively and for whom its use is more integrated into their academic practice, rather than sporadic or occasional users (as noted in the interviews, conferences can be a prompt to use the platform, and as such a conference hashtag may not reflect typical use).

Veletsianos and Kimmons's (ibid.) findings also contrast with Stewart's (2015b) findings that metrics such as follower and following counts do not play a substantial role in academics' assessment of reputation of others on the platform, and the through the site, "the norms of open online participation helped minimize academia's hierarchies for participants" (Stewart, 2015b, p.19). As Donelan (2016) observed, further benefits are found in academics' use of social media with increasing levels of use. The contrasting results would suggest that a combination of hierarchy and activity level are at play; and that when doctoral students actively engage with the platform, there are greater rewards to be had. It should also be noted that on Twitter, PhD students' networks showed the highest level of reciprocity, and professors the lowest, so Twitter preserves academic hierarchy in this sense. Note that no evidence was found on either platform to suggest a

relationship between network size and reciprocity, so the professors' lower reciprocity is not likely to be related to their network size per se.

An advantage of the present study is that the mixed methods approach used here provides further insight beyond the level of metrics. The greater reciprocity in networks of graduate students is indicative of more active networking building on their part and may relate to the perception that networking is a key process for students to undertake as part of their career development, which was a finding in both the survey and interview data (Section 7.13.3). Graduate students (along with researchers) showed higher levels of agreement compared to other groups for the survey item '*attracting future employers*'. All groups except professors (graduate students, researchers, and lecturers) showed a median category of 'agree' for the items '*I follow people who I would like to work with in the future*', '*having a profile will enhance my future career prospects*', and '*social networking sites are useful to discover job opportunities*'.

In relation to understanding the processes behind network construction, the theme of 'finding a niche' reflects the higher reciprocity and agreement with networks playing a role in career development (Section 8.2.3). Codes relating to 'finding a niche' were raised in interviews by all of the PhD students and researchers (Section 7.13.3), in contrast to a third of lecturers and a quarter of professors. The importance of finding a niche and building an academic identity for doctoral students mirrors findings from Esposito (2015), who identified strategies of weaving and splitting professional identities across different platforms, and choosing carefully what not to share online, in her study of doctoral students. The present study reinforces this finding, and also extends it by finding that the issues persist further in academic careers too (Section 8.2). Researchers often recalled

starting their networks during their recent graduate studies, and their use has continued into their postdoctoral careers.

> "I had an Academia[.edu] account, a few years ago, I think when I started my PhD and I was very enthusiastic about social media and everything as one is at that stage."
> "I think [started using Twitter] must've been during my Master's degree or the first year of my PhD, so that would have been probably around 2010 or 2011. […] I think it was about that move to develop an online profile, 'cos I very much see my Twitter account as a professional thing, if you like, it's a space for my academic identity." - Kieran

All of the researchers included in the interview sample (Beth, Carol, Gillian, Kieran, and Quentin) were postdoctoral researchers, having completed their doctorates in recent years, working on research projects and not employed on permanent contracts. As such, researchers showed similarly high levels of agreement with survey items in relation to career development (discussed previously in relation to doctoral students), and is reflected in a continued desire to find a niche:

> [On Twitter] "I've started following various colleagues and research networks and professional and policy networks […] just as an information source, not so much that I'm sharing anything. […] On Twitter people seem to specialise in particular things that they tweet about, and I am currently just sort of tweeting about this that and the other and not really anything in particular [...] I need to find my niche." - Beth

The survey response and interviews show a slightly different character to 'finding a niche' for researchers. With a greater level of research experience behind them compared to doctoral students, promoting their research rather than themselves personally is viewed as more important post-doctorate. Two items in the survey showed median categories of 'agree' for researchers in contrast to 'neither agree nor disagree' for all other categories; '*sharing authored content*' and '*raising the profile of your work in the research community*'. It is also notable that while they share the need to find a niche and secure permanent jobs, this was not raised by doctoral students, which may reflect findings that doctoral students are reluctant to share research for a combination of reasons, including awareness of what is permitted by publishers and influenced by their supervisors' views on the

legitimacy of openness in scholarly practice (Carpenter, Wetheridge & Smith, 2010). However, a perception that researchers face compromises in relation to their freedom to network and use social media was alluded to, through the 'academic freedom' theme (Section 8.2.3).

> "That's something that came up in my own work about the freedom that say an academic at a university has compared to an academic employed by a government science organisation, *there's a lot more freedom at a university, and then being a student you get a lot more freedom again*, so I definitely think that the way that I act, there's no consequences of what I do, I mean there's consequences in terms of I want to be a good researcher, I want my research to be rigorous, I want it to be ethically sound. […] *It's your responsibility,* you're the one who's putting the information out there, you're the one who deals with the *consequences*." - Emily

The lecturers included in the sample held permanent academic appointments, two of the six being in senior positions (Frances and Pippa). Lecturers still agreed with two of the careers-related survey items already discussed. Additionally, lecturers and professors showed a greater level of agreement (median category of 'agree') with the survey item '*I use social networking sites to support my teaching activities*'. In the qualitative analysis of the interviews, 'promotion and impact' and 'extending academic space' were both most prevalent in the lecturers' category. The interviews explain that these are priorities for lecturers, in order to maintain an active profile as a researcher in the face of heavy teaching loads.

> "[The purple community is] removed from the rest of it, which is kind of how I feel about my job, because I can't have PhD students at [University A] because there's no funding, I have a heavy teaching load, I have to get these [overseas] fellowships to get any time to write books and articles, I mean it's silly that I have to go to [overseas location] to get publications done, so that does represent actually how I feel about my institution and my job there, that I kind of, *the real stuff is happening in orange and blue, it's not happening in purple*. I mean I can't tell purple [University A] that, but [laughs] purple's not going to see this and know that's how I feel and that's how I act." - Nicola

Professors enjoy the largest networks on average on both academic SNS and Twitter. There is a substantial difference between the number of people they follow and their followers on both types of platforms (followers outweighing the number of people they choose to follow), although the disparity is greater for academic SNS.

In the context of academic SNS, professors' networks showed significantly lower clustering compared to other job positions. Given the dramatic difference in terms of followers and following observed for professors on academic SNS, the lower clustering could be explained by having a much greater proportion of members of the network who are following due to their fame or reputation, who do not know other members of the network.

In terms of how professors view and use their networks, the group showed disagreement with the survey items already discussed in relation to jobs and careers, but did agree (like lecturers) that they do use online networks in their teaching. Although the professors do not perceive a value in relation to their own career development and gaining future employment, their participation in the network is important for the mechanism to work for more junior academics to build relationships and realise these goals (see Section 8.1, in relation to social capital).

> "I'm quite secure in my job, I'm quite senior, I'm not looking for a lot of help from people but I spend a lot of time reading CVs and shortlisting people and appointing people and I know how hard it is and how those things play out and people having warm fuzzy feelings about you is good, it matters." - Harriet

In the qualitative analysis, the theme of 'circumventing institutional constraints' was a key motivation for professors to use academic SNS (Section 7.13.3). This was frequently borne out of a desire to improve access and dissemination to their research publications, coupled with restrictions on the speed, ease and criteria for depositing items in their institutional repositories.

> "It is a little bit slower to get papers up on the institutional repository, particularly now with the new REF guidelines that everybody has to be open access, I think our institutional repository guy is pretty over-worked at the moment. *With ResearchGate I can get a paper up there within seconds; with our institutional repository, it may be days, weeks, months*." - Lucy

In conclusion, sampling from across a range of job positions has provided rich insight into the ways that different pressures act at different career stages, and links to how academics utilise and develop their online networks in response to these pressures.

The three strands of identity-trajectory (McAlpine & Akerlind, 2010) provides a way of conceptualising the role of online networks in relation to academic work. The *networking strand* is explicitly related to the perceived use of doctoral students in relation to network building and actively seeking connections to others within their field. Researchers leverage the *intellectual strand* through their use of the sites to promote the profile of their research and experience. Aware that maintaining an active profile as a researcher is key to further promotion within the academy but at odds with teaching-heavy roles, lecturers exploit their networks in order to do so, drawing upon their resources accrued through existing *networking* and overcoming barriers created by the *institutional strand* of their identity. The role of professors is curious because although the size and embeddedness of their position within networks reflects an accomplished *networking strand*, their use of the sites is in contrast with the other categories. Despite being more secure in their formal positions within home institutions, professors are not empowered to freely control their online identity through their institutions and use of online networks (particularly academic SNS) provides a way of circumventing this, inflecting the *institutional strand* through an online lens.

While the analysis extends and complements previous work which has focused upon doctoral students and ECRs, there are also some limitations due to the practical constraints of the sample here. In order to ensure that a range of positions across academic career trajectories were represented, the sampling

strategy focused upon those which fell into particular categories of job position (doctoral students, researchers, lecturers, and professors). This purposefully excluded potential participants who did not fit within these categories, such as para-academics, and those between formal academic roles and institutional affiliations. Academics can also support multiple identities in this sense (such as being a lecturer and doctoral student at the same time), and online networks could be of greater importance in this sense (Bennett & Folley, 2014). Further follow-up work with academics working outside of formal academic roles and beyond the UK HE context would be valuable.

9. Conclusions and future directions

This concluding chapter will summarise the novel contribution to knowledge that this study has provided, while acknowledging its limitations and setting out directions for future research to build upon the findings.

9.1 Summary of contribution to knowledge

This study has provided a rich account of the structure of academics' ego-networks on two main types of SNS which are used in their professional practice, namely academic SNS (Academia.edu or ResearchGate) and Twitter. The study has been underpinned by a broad question of 'how are social networking sites (re)shaping academic roles and relationships?'. Informed by conceptual and methodological gaps in the existing literature, the study has foregrounded the networked aspect of SNS, and how the phenomenon is experienced by the academics involved.

While care has been taken to ensure the validity of the findings within the bounds of the study, it is also important to reiterate the limitations inherent in the work due to the scope of the sample. The online survey provided a baseline of information about how academics use online social networks professionally, and created a pool of potential participants who opted-in to take part in the networks analyses and interviews. Although the online survey accrued a substantial number of responses, including a full range of job positions, disciplines, and geographical locations, there are two key limitations to this dataset. First, survey participation was on an opt-in basis, and the sample will be biased towards self-selection; and second, whilst the URL was publicised on several platforms online, it circulated to

a greater extent on Twitter, so the sample is likely to be biased to include more active Twitter users. These limitations are also carried through to the network analyses and interviews, which the additional caveat of being based in the UK and having formal institution affiliations at the time of recruitment. The scope of the study and results are therefore more likely to be representative of UK-based, social media active academics with formalised institutional affiliations, rather than academics as a broader whole.

To recap, the following questions guided the study:

- RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?
- RQ2: How do academics construct and understand their ego-networks?
- RQ3: Does the structure and/or role of the network differ in nature according to academic career trajectories?

The relationship between the RQs and methods (introduced in Figure 4.1) is expanded in Figure 9.1.1, to illustrate the results and related theory.

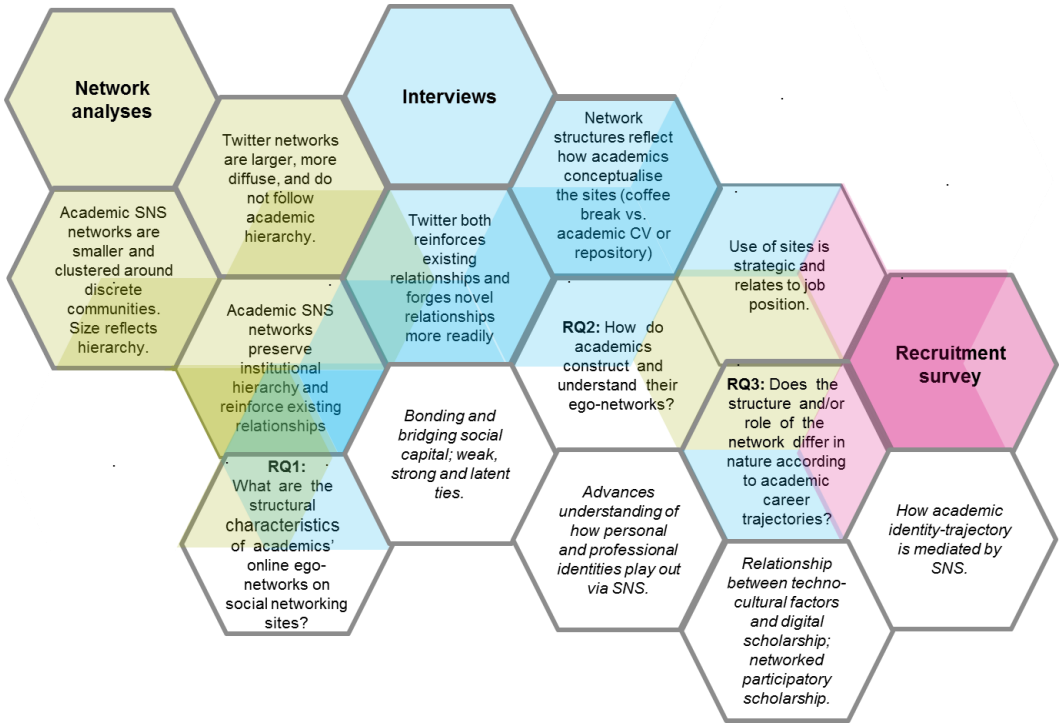


Figure 9.1.1: Summary of the relationship between the RQs, methods, findings, and related theories.
Colour coding shows how different research methods (pink denotes the survey results; green, the network analyses; and blue, the interviews) and their results have informed the conclusions; related theoretical positions shown in white.

In the following sections, the contribution of the work will be summarised in relation to:

(i) academic identity and networked participatory scholarship,

(ii) SNS from a wider Internet Studies perspective,

(iii) social media research methods.

The key conclusions will be presented in bullet point form before being discussed. The results will be of interest to both academics interested in developing their online profile, and the wider Internet Studies community.

9.1.1 Understanding networked participatory scholarship through academics' use of SNS

RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?

- Networks on academic SNS are smaller, more dense, more highly clustered around institutional communities and showing greater reciprocity, in comparison to those fostered by Twitter.
- Twitter networks are larger and more diffuse; research topics and interests are much more likely to define communities.
- Connections are made in different ways on the different platforms.
- Academic SNS replicate and reinforce existing professional connections (building bonding social capital).
- Twitter reinforces existing professional relationships and fosters novel connections to a greater extent (bonding and bridging social capital).

RQ2: How do academics construct and understand their ego-networks?

- The trends observed in network structure reflect the different ways that academics conceptualise the role of Twitter and academic SNS.
- Academic SNS present a formal academic identity, akin to a CV or personal repository, and are perceived to benefit a mainly academic audience.

- Participants perceive an expectation of ‘authenticity’ when using Twitter, even when used for professional purposes, requiring a combination of professional and some personal information to develop a fuller sense of the individual. This can be challenging, but affords the benefit of building valuable relationships with previously unknown academics.
- Several strategies were identified as to why academics choose to construct and use these online networks, including: ‘circumventing institutional constraints’; ‘extending academic space’; ‘finding a niche’; ‘promotion and impact’; and ‘academic freedom’.
- The strategies make the previously unexplored link between academic identity development online and formal academic identity and institutional roles, including more senior academic positions.

RQ3: Does the structure and/or role of the network differ in nature according to academic career trajectories?

- Network size metrics closely mirror academic hierarchy on academic SNS; PhD students have the smallest networks. While professors have the largest networks, this is largely due to having far more followers than those they choose to follow.
- This trend is not found in the Twitter data. In contrast, professors and PhD students have the largest networks. This suggests that if PhD students actively engage with the site, it does offer the opportunity to build a network and profile beyond their novice status.
- Across the three types of data collected, more differences in relation to job position were apparent than due to discipline.

- The strategies used to develop online networks show clear distinctions according to job position and link to academic identity-trajectory. ‘Finding a niche’ is key for PhD students and postdoctoral researchers; ‘extending academic space’ and ‘promotion and impact’ are important to mid-career academics; and ‘circumventing institutional constraints’ (to create an online identity they control, or open access to their research) was a priority for professors. PhD students and professors felt the greatest levels of academic freedom.

Networked participatory scholarship (Veletsianos, 2016; Veletsianos & Kimmons, 2012) emphasises the role of online networks in mediating digital scholarly practices (Weller, 2011) and proposes that in order to understand the interplay of social and technical factors which mediate how it is enacted, a focus upon academics and their practices is necessary. By foregrounding the participants and co-interpretation of their online network structures, the study has provided a rich account in this spirit, and a strong empirical base for understanding the relationship between particular platforms – academic SNS and Twitter – and academic roles and practices.

The study took the structures of academics’ ego-networks on academic SNS and Twitter as a starting point, as:

- the network structure of such platforms is a fundamental aspect of any SNS but has not been examined in an academic context; and
- social network structure in other contexts has been shown to relate to social capital, which made it useful to examine bearing in mind the over-arching question of whether online networks are reshaping academic roles and

networks (perhaps redistributing social capital beyond traditional academic hierarchies).

The SNA phase identified trends in network structures; academic SNS networks were smaller and more highly clustered, while Twitter networks were larger and more diffuse. From the co-interpretive interviews, annotating the networks revealed that institutions and research interests define communities on academic SNS, while research interests and personal interests define communities on Twitter. Academic SNS replicate existing professional connections; Twitter reinforces existing professional relationships and fosters novel connections to a greater extent. In social capital terms, the network structures and interview data here suggest that academic SNS represent bonding social capital, reifying existing relationships, while Twitter is a site which both builds bonding and bridging social capital, building new connections, activating latent ties more readily and allowing old and new relationships to be strengthened (Haythornthwaite, 2002; Crossley et al., 2015).

The differences in network structures are perceived by academics to relate to differences in the ways they use the sites. Academic SNS were regarded as a more formal academic identity, akin to a business card, or used as a personal repository. Twitter is viewed as a space where personal and professional are mixed; a key metaphor being that of a conference coffee break. These differing conceptualisations reflect different sense of academic identity and audiences, and helps characterise the concept of ‘acceptable identity fragments’ (Veletsianos & Kimmons, 2014) through SNS participation. The study here suggests that different platforms represent distinct but overlapping AIFs, although the relationship between the fragments is less of a ‘constellation’ (Veletsianos & Kimmons, 2014)

and better conceptualised as being aligned with a spectrum of identities and audiences from personal to professional (and private; that which is not shared online at all). This aligns with other recent work on academic identity online which has suggested a personal-professional identity divide (Josefsson et al., 2015; Kieslinger, 2015).

Thematic analysis of the interviews identified a number of strategies which influences academics in their use of online SNS. The theme included: circumventing institutional constraints; extending academic space; finding a niche; promotion and impact; and academic freedom. The themes represent a novel contribution to understanding the relationship between academics' SNS use and the formal academe.

Academic identity and development is a dynamic process in its own right and likely linked to how academics' online identity is expressed. However, few studies have bridged this gap (Esposito, 2015). The study was designed with the theory of identity-trajectory in mind from the outset (McAlpine & Akerlind, 2010). The structure and strategies of using SNS reflect differing pressures and relationships with formal academia over the course of academic careers. Disciplinary differences were not as pronounced, which may suggest that digital scholarly practices represent a shift in academic working across the sector, rather than exhibiting a different character in different disciplinary settings (Weller, 2014).

9.1.2 Understanding SNS dynamics across multiple platforms and contexts

RQ1: What are the structural characteristics of academics' online ego-networks on social networking sites?

- The results suggest contrasting links between network structure and social capital on each platform, which has been examined on other sites (notably Facebook).

RQ2: How do academics construct and understand their ego-networks?

- Identity is presented in different ways on different sites, although there is overlap between the audiences and sites.
- The results suggest that online academic identity via SNS sits within a continuum between personal and professional identities. Participants are highly aware of the perceived hazards of mixing aspects of identity online, and may choose not to share what they consider entirely personal online at all.

In addition to being of practical use to the academic community, the study makes a contribution to the broader topic of SNS within the field of Internet Studies. First, it shows how concepts derived from seminal work on teenagers use of SNS (boyd, 2008) are recast in the context of more formalised, authentic, professional identities and roles. Second, the study also represents a multi-platform social media study. The results throw into sharp contrast the roles that different forms of SNS platforms can play in practice. The basic measure of connection for all the platforms in the study – the follower-following relationship – held nuanced differences in meaning for participants on academic SNS in contrast to Twitter.

This underscores the importance of multi-platform studies, as sites which share characteristics can be playing very different roles in practice and highlights the critical role for qualitative work to accompany social media data in order to account for context.

9.1.3 Methodological insights as a multi-platform social media study

As a multi-platform social media study, a number of issues have been raised which may be of interest and relevance to other multi-platform social media studies, which is an under-studied and emergent area of social media-based research (Hall, Mazarakis, Peters, Chorley, Mai, Caton & Strohmaier, 2016). Multi-platform studies pose an immediate challenge for sampling, in that a sample that is representative of the population of one platform may not be representative of another. This does not invalidate studies but requires careful consideration of the research context and framing the results clearly so that the extent to which results are generalizable is made explicit.

This issue is evident in the example of differences in the degree distributions of the participants in the study, across the two types of platform involved. Although information about the online survey and URL was posted by the researcher on all three sites, the information circulated to a greater extent on Twitter. This greater level of recruitment via Twitter is reflected in the sample, in that it is likely that the Twitter users in the sample are not representative of Twitter academics as a whole, but is biased towards more active users. This is borne out by the degree distributions for Twitter and academic SNS in the sample, shown in Figures 9.1.3.1 and 9.1.3.2 respectively.

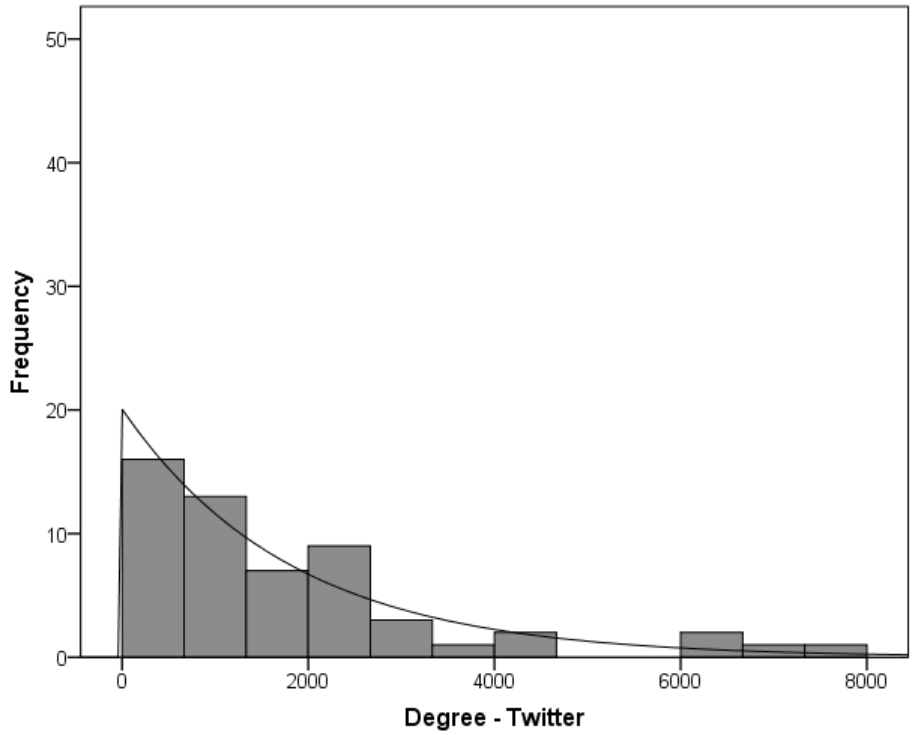


Figure 9.1.3.1: Degree of participants' networks on Twitter, with fitted exponential curve (N = 55).

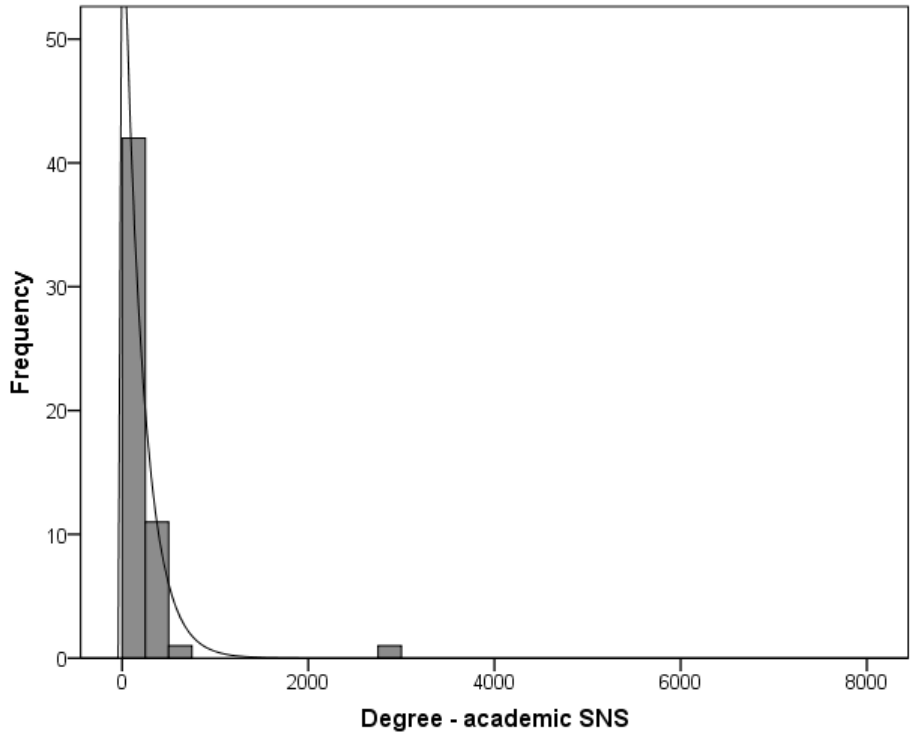


Figure 9.1.3.2: Degree of participants' networks on academic SNS, with fitted exponential curve (N = 55).

We would expect degree distributions to fall off steeply and have heavy tails, a fundamental characteristic of social networks (Barabasi, 2011). The degree distribution for the academic SNS networks does appear to demonstrate this pattern. In contrast, the degree distribution for Twitter appears truncated (the expected high proportion of low degree networks is under-represented). It is possible that academics with a low degree network on Twitter were less likely to have seen the recruitment message.

It may not be possible to construct samples which are simultaneously representative of more than one platform, if behaviour on one platform is not correlated with that on the other. For example, in the study here, network size (in terms of number of nodes) on academic SNS was significantly correlated with network size on Twitter, although there was no significant correlation between the two in terms of number of communities, network density, reciprocity or clustering across the two platforms (Chapter 6).

The study also questions the extent to which data collected from different platforms can be considered equivalent, and the importance of putting online data in context. For each of the platforms included in the study, different approaches were required to access network data. In order to construct and analyse the networks, the data for each network was ultimately brought together in the same format (CSV data, as a series of ‘source’ and ‘target’ nodes). A combination of social and technical factors that necessitated these different approaches and makes the issue hard to resolve with certainty. The approaches selected for data collection on each site took into account several factors, including: technical access to the data; terms of service of the sites; and ethical considerations and participant consent.

The Twitter API represented the only feasible method of acquiring network data from the platform; NodeXL was used to run queries and collect data from the API (Smith et al., 2009). However, the Twitter API places certain restrictions on the amount and frequency of data that can be collected (it is 'rate limited'). As a result, to avoid prolonged data collection, NodeXL will only collect the first 2,000 followers or following (B. Hogan, personal communication, July 5, 2016). This immediately excluded a number of participants from network analysis beyond degree. For all others, there remained an element of uncertainty regarding how NodeXL would treat other highly-connected nodes within an ego-network. NodeXL gives the option to only collect connections between a specified list of IDs, and collects follower and following data for each ID, so any connections which would be valid in the context of an ego-network would have two chances to be collected, but it is impossible to accurately account for how much data may be missed as a result and its effect on the network.

The network data collection and co-interpretive interviews raise the question of whether connections between profiles can be considered to be personal data. Whether or not social network data counts as personal data has implications for data protection and the legal rights of the individuals concerned (Data Protection Act, 1998) to access and use the information. Several of the interview participants, particularly with reference to their Twitter networks, remarked about how much they had enjoyed being able to view their networks as visualisations, and had great emotional attachment to their online connections. However, in the case of the academic SNS particularly, it was not clear whether collecting and visualising the networks was in contravention of their ToS. As discussed in Section 4.6, informed consent was obtained by the participants ahead of network data

collection, in order to ensure the project stance was ethical. However, whether network data is personal data or otherwise remains a question for debate.

9.2 Limitations of the study

While the 18 case studies which form the evidence base for this study provide rich data and insight, there is a question of to what extent the results are generalizable. While the survey results follow the same trends as the much larger Nature survey dataset (when ranked, the relative importance of the verbatim questions is identical), the online survey sample showed a higher level of agreement, which might indicate that the online survey sample represents a group of higher use level academics (Donelan, 2016). It is notable that the relative priorities remain the same across both groups. However, both surveys suffer from potential bias due to self-selection. As such, neither dataset is representative of academia as a whole. Non-users of social media and those who do not regard social media as being important or useful are less likely to be represented in both surveys.

Different levels of use are likely to account for the differences observed in terms of Twitter network size, when compared to the study by Veletsianos and Kimmons (2016). The sampling strategy used by Veletsianos and Kimmons selected academics for inclusion on the basis of using a particular conference hashtag, while participation in the present study required academics to view the invitation (by social media) and opt in to complete the survey, for later inclusion in the network analysis. The sampling strategy used by the present study offers the advantages of not being restricted to one subsample (a conference) of a particular discipline but draws upon a range of disciplines, and is more likely to include participants who regularly use Twitter in their academic practice, rather than

occasional users. The trends in network analysis of academic SNS are supported by an independent study focusing on particular institutional communities on ResearchGate (Hoffmann, Lutz & Meckel, 2014; Hoffmann, Lutz & Meckel, 2015; Lutz & Hoffmann, 2015).

The sampling strategy purposefully set criteria of participants being UK-based, in one of four particular job positions, and one of three particular disciplines. This strategy was used to ensure a range of viewpoints were represented, and look for differences along seniority and disciplinary lines. However, Singh (2016) suggests that academics' experiences of Twitter are linked to socio-economic notions of privilege. Expanding the focus to include international academics and para-academics, who may be more liminal to formal institutional communities, would provide a useful complement.

9.3 Practical implications

The findings of this study have practical implications, both for academics who wish to develop their online professional identity and use online social networks, and also for developers of academic SNS platforms.

For academics, a major barrier to uptake of social media for professional use is a perception that sites are not useful, or lacking awareness of the roles that different platforms can play (NPG, 2014). The findings here emphasise that not all social media tools have the same affordances, and particularly the roles played by academic SNS and Twitter. For an academic wishing to develop their online presence, the choice of which academic SNS to use to host their formal identity and papers may be informed by the disciplinary differences observed between Academia.edu and ResearchGate. However, the potential for connecting with new

professional connections and audiences through academic SNS is limited compared to Twitter, so it is recommended that academics host their identity and files on academic SNS but also share links to them through Twitter. The study highlights how the tools are particularly helpful for early career academics, and that for those who actively engage with the platforms, this can go some way to raising your profile beyond the academic hierarchy.

For those seeking to develop or enhance academic SNS platforms, the findings here show that the ways that academics conceptualise the sites and build their networks may be at odds with what the sites themselves seek to achieve. Academic SNS do appear to succeed as a way of hosting a formal academic identity and publications, and as such provide an important platform particularly to early career academics and are succeeding in their goals to act as a type of publishing platform. However, if the social network structure is an important part of an academic SNS, further attention may be needed to assist in mechanisms to help academics connect. At present, the main academic SNS do not offer suggestions for novel connections, and rather than fostering new connections, the social network that grows organically largely reflects pre-existing connections rather than new ones.

9.4 Future research directions

A number of future research directions would be valuable to extend and build upon the findings of this study.

The study has provided new insights into the roles played by SNS in academics' professional lives, although the sample is arguably small. This is in keeping with the exploratory nature of the study at hand. A further confirmatory study could be

undertaken to explore the emergent themes at a larger scale, possibly via a survey. It would however need to be mindful of which platforms participants were specifically being asked to consider, as the present study highlights nuances in conceptualisation of different sites and calls into question the value of studies which examine academics' use of social media as a homogenous whole.

Differences according to job position, and particularly the perceived benefits of online networking to students and ECRs, raise questions of the extent to which actual benefits accrue over time. Would the differences in network sizes, for example, mean that the larger Twitter networks of current doctoral students translate into larger researcher and lecturer networks over time, or is it an intrinsic characteristic of these roles to curtail online participation? Longitudinal studies could be valuable in examining such changes over time.

Such questions also allude to whether the results show the beginning of a cultural shift which will permeate upper levels of academia with time. The lack of difference in relation to disciplines may be indicative of a larger cultural shift towards embedding digital scholarly practices. Furthermore, the links between strategic use of tools, particularly Twitter, and formal academic institutional constraints and responsibilities raises a question of how Twitter may be being co-opted and reshaping other professions.

10. References

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Appendices

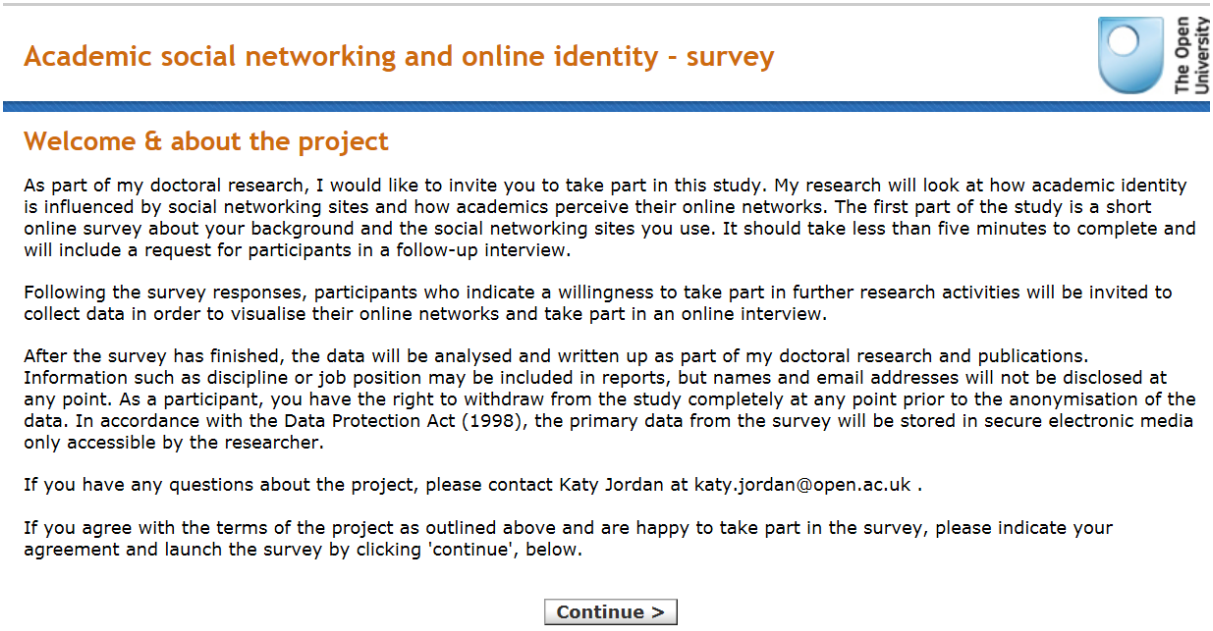
Appendix A: Levels of use of different social media platforms by academics

Study	Madhusudhan (2012)	Ruleman (2012)	Nature Publishing Group (2014)	Lupton (2014)
Question	Use tools	Using it more lately/use it all the time	Aware of site and visit regularly	Use site as part of their professional academic work
N =	160	123	3509	711
Academia.edu			8.1	49
A blog	57.5			32
Bebo		0		
BioMedExperts			4	
Curation tools				7
Delicious	11.25	4.9		
Diigo				
Facebook	77.5	49.6	40.5	42
Figshare			0.5	
Flickr	40	5.9		5
Friendster		0		
Frontiers			5	
Google+			21.7	21
Google Scholar			62.6	1
Instagram				3
Library Thing	11.25			
LinkedIn	10.62	15.5	40.8	60
Mendeley			7.7	
Microsoft Academic			1.4	
MLA Commons			0.1	
My Science Work			0.9	
MySpace	23.75	1.6		
ORCID			7.2	
Orkut	10			
Pinterest				9
Pubchase			0.7	
Researcher ID			11.9	
Quora				1
ResearchGate			46.2	33

Study	Madhusudhan (2012)	Ruleman (2012)	Nature Publishing Group (2014)	Lupton (2014)
Question	Use tools	Using it more lately/use it all the time	Aware of site and visit regularly	Use site as part of their professional academic work
N =	160	123	3509	711
Second Life		3.2		
Slideshare	20			13
Skype		22.5		
Storify				9
Tumblr				5
Twitter	17.5	5	14.4	90
Wikis	85			
Wikipedia				7
YouTube	60			25
Zotero		2.5		
Online referencing e.g. mendeley, zotero				20

Appendix B: Screen captures of the online survey

Page 1



Academic social networking and online identity - survey

The Open University

Welcome & about the project

As part of my doctoral research, I would like to invite you to take part in this study. My research will look at how academic identity is influenced by social networking sites and how academics perceive their online networks. The first part of the study is a short online survey about your background and the social networking sites you use. It should take less than five minutes to complete and will include a request for participants in a follow-up interview.

Following the survey responses, participants who indicate a willingness to take part in further research activities will be invited to collect data in order to visualise their online networks and take part in an online interview.

After the survey has finished, the data will be analysed and written up as part of my doctoral research and publications. Information such as discipline or job position may be included in reports, but names and email addresses will not be disclosed at any point. As a participant, you have the right to withdraw from the study completely at any point prior to the anonymisation of the data. In accordance with the Data Protection Act (1998), the primary data from the survey will be stored in secure electronic media only accessible by the researcher.

If you have any questions about the project, please contact Katy Jordan at katy.jordan@open.ac.uk .

If you agree with the terms of the project as outlined above and are happy to take part in the survey, please indicate your agreement and launch the survey by clicking 'continue', below.

Continue >

Page 2

Academic social networking online survey

Edit this page

Part 1 - Background

About you

1. Your name *(Optional)*

2. Your email address *(Optional)*

3. Your current university *(Optional)*

4. Which subject area do you work in?

- ○ Anthropology
- ○ Archaeology and Classics
- ○ Art and Design
- ○ Astronomy and planetary science
- ○ Biological Sciences
- ○ Business and Management
- ○ Chemistry
- ○ Computer Science
- ○ Culture and Media Studies
- ○ Dance, Drama and Music
- ○ Economics
- ○ Education
- ○ Engineering
- ○ English
- ○ Finance and Accounting
- ○ Geography, Earth and Environmental Science
- ○ History
- ○ Journalism
- ○ International Relations
- ○ Language and Linguistics
- ○ Law
- ○ Materials Science
- ○ Mathematics and Statistics
- ○ Medicine
- ○ Philosophy
- ○ Physics
- ○ Politics
- ○ Psychology
- ○ Religion
- ○ Sociology
- ○ Social Work and Social Policy
- ○ Veterinary Medicine
- ○ Other *(please specify)*:

5. Which best describes your current position: *(Optional)*

- ○ Graduate student
- ○ Academic support
- ○ Researcher
- ○ Lecturer
- ○ Professor
- ○ Other *(please specify)*:

6. How often do you use the following social networking sites? If you do not have a profile, please select 'N/A' for that particular site.

	Most days	Most weeks	Monthly	Rarely (less than once a month)	I created a profile at the site but have not used it since	N/A	Any comments (optional)
a. Academia.edu	○	○	○	○	○	○	
b. A blog	○	○	○	○	○	○	
c. Diigo	○	○	○	○	○	○	
d. Facebook	○	○	○	○	○	○	
e. Google+	○	○	○	○	○	○	
f. LinkedIn	○	○	○	○	○	○	
g. Mendeley	○	○	○	○	○	○	
h. ResearchGate.net	○	○	○	○	○	○	
i. Slideshare	○	○	○	○	○	○	
j. Twitter	○	○	○	○	○	○	
k. Zotero	○	○	○	○	○	○	

Continue >

Page 3

Academic social networking online survey

Edit this page

Part 2 - Uses & perceptions of academic social networking sites

7. Thinking about your use of social networking sites in general, please indicate the extent that you agree with the following statements. If you feel that you agree with a statement in relation to one site but not another (e.g. LinkedIn but not Facebook), please add a comment to describe this.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Comment? (optional)
a. I see my profile as an online business card	○	○	○	○	○	
b. I use social networking sites to discover peers working in my field of research	○	○	○	○	○	
c. Social networking sites are useful to raise your personal profile in the research community	○	○	○	○	○	
d. Social networking sites are useful for attracting funding	○	○	○	○	○	
e. I follow people as a way of staying in touch with people I used to work with	○	○	○	○	○	
f. Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	○	○	○	○	○	
g. I use social networking sites to track metrics relating to interest in my work	○	○	○	○	○	
h. Social networking sites are a good way of finding out about new publications of interest	○	○	○	○	○	

i. Social networking sites are useful to share authored content (e.g. papers, datasets, protocols)	○	○	○	○	○	
j. I use social networking sites to discover individuals outside my field of research	○	○	○	○	○	
k. I don't think having a professional profile on an online network is very important for a researcher	○	○	○	○	○	
l. Developing my online identity is important to me as an academic	○	○	○	○	○	
m. Social networking sites allow me to draw upon a wider community of expertise when I need help	○	○	○	○	○	
n. Being able to ask questions of the online community is important	○	○	○	○	○	

o. Social networking sites are a good way of promoting my own academic publications	○	○	○	○	○	
p. I feel I should probably do more to promote my research using online networks	○	○	○	○	○	
q. My online academic and personal identities are separated	○	○	○	○	○	
r. I use my profile as a research journal	○	○	○	○	○	
s. Social networking sites are useful to raise the profile of your work in the research community	○	○	○	○	○	
t. Social networking sites are useful to discover job opportunities	○	○	○	○	○	

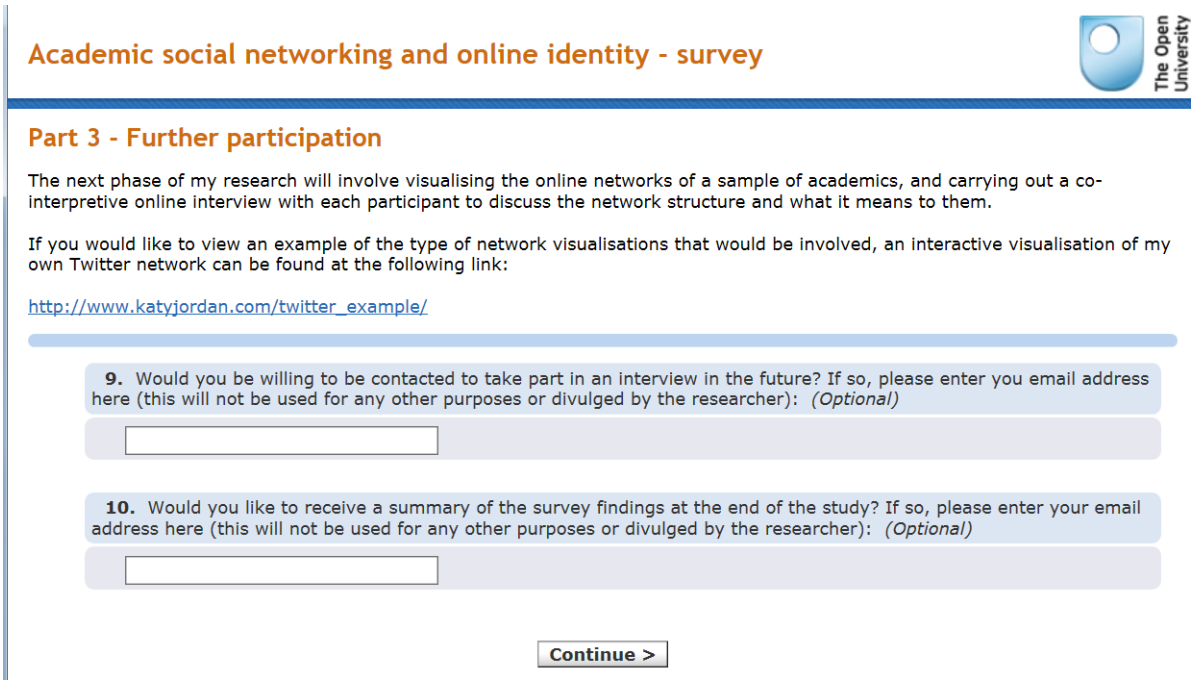
u. I actively interact with other academics via social networking sites	○	○	○	○	○	
v. Social networking sites help to attract collaborators	○	○	○	○	○	
w. If someone follows me, I follow them back	○	○	○	○	○	
x. Having a profile will enhance my future career prospects	○	○	○	○	○	
y. Social networking sites are useful for attracting future employers	○	○	○	○	○	
z. I follow people who I would like to work with in the future	○	○	○	○	○	
aa. Social networking sites are a useful way to support working in collaboration with other researchers	○	○	○	○	○	
ab. I use social networking sites to support my teaching activities	○	○	○	○	○	
ac. I only follow people who I know personally	○	○	○	○	○	
ad. I present my identity in different ways on different sites	○	○	○	○	○	

8. If there are any particular benefits or functions of social networking sites which are important to you but not listed above, please describe them briefly here: *(Optional)*

More Info

Continue >

Page 4



Academic social networking and online identity - survey

The Open University

Part 3 - Further participation

The next phase of my research will involve visualising the online networks of a sample of academics, and carrying out a co-interpretive online interview with each participant to discuss the network structure and what it means to them.

If you would like to view an example of the type of network visualisations that would be involved, an interactive visualisation of my own Twitter network can be found at the following link:

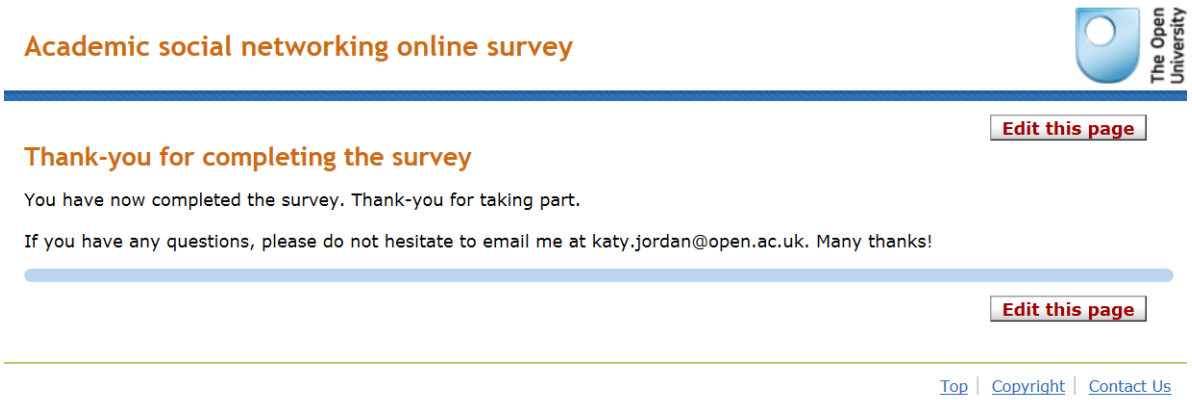
http://www.katyjordan.com/twitter_example/

9. Would you be willing to be contacted to take part in an interview in the future? If so, please enter you email address here (this will not be used for any other purposes or divulged by the researcher): *(Optional)*

10. Would you like to receive a summary of the survey findings at the end of the study? If so, please enter your email address here (this will not be used for any other purposes or divulged by the researcher): *(Optional)*

Continue >

Page 5



Academic social networking online survey

The Open University

Edit this page

Thank-you for completing the survey

You have now completed the survey. Thank-you for taking part.

If you have any questions, please do not hesitate to email me at katy.jordan@open.ac.uk. Many thanks!

Edit this page

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Appendix C: Subject areas and disciplines coding scheme

Subject areas and disciplines coding scheme

1 = Humanities
- Art and Design
- Dance, Drama and Music
- English
- History
- Language and Linguistics
- Religion
- Philosophy

2 = Social Sciences
- Anthropology
- Archaeology and Classics
- Culture and Media Studies
- Economics
- Sociology
- Politics
- Psychology
- International Relations

3 = Natural Sciences
- Astronomy and Planetary Science
- Biological Sciences and Biochemistry
- Chemistry
- Geography, Earth and Environmental Science
- Physics

4 = Formal Sciences
- Computer Science
- Mathematics and Statistics

5 = Professions
- Business and Management
- Education
- Engineering
- Finance and Accounting
- Journalism
- Law
- Social Work and Social Policy
- Veterinary medicine
- Medicine and Biomedical Sciences
- Materials Science

Job positions coding scheme

1 = Professor (includes: Professor, Head of Academic Department/Faculty)
2 = Lecturer (includes: Lecturer, Assistant Professor, Associate Professor)
3 = Researcher (includes: Post-doctoral fellow, Principal Investigator, Research Scientist, Technician/Research Assistant, Staff scientist, Senior scientist)
4 = Graduate student (includes: PhD student)
5 = Other (i.e. everything which doesn't fall within categories 1 to 4)

Appendix D: Human Research Ethics Committee proforma

Open University research involving human participants or materials has to be reviewed and where appropriate, approved by the HREC. To apply to HREC, please complete and email this proforma to Research-Rec-Review@open.ac.uk. You will need to attach any related documents such as a consent form or information sheet, so that a full application can be considered by the HREC Review Panel. Omitting any documents may result in a delay to the review process.

If you have any queries about completing the proforma please look at the Research Ethics website, in particular the FAQs - http://www.open.ac.uk/research/ethics/FAQs.shtml which includes a set of Generic Protocols and Templates (http://www.open.ac.uk/research/ethics/FAQs.shtml#Generic). You can also contact the HREC Chair or Secretary.

The submission deadline for applications is **every Thursday** at **5.30pm** when they will be assessed for completeness and then sent to the HREC Review Panel. Once an application has been passed for review you should receive a response within 10 working days.

All general research ethics queries should be sent to Research-Ethics@open.ac.uk, or call the **HREC Secretary** on ☎ **01908 654858**.

Please complete all the sections below – deleting the inserted instructions.

Project identification and rationale

Title of project

Understanding the structure and role of academics' ego-networks on social networking sites

---

Abstract

This study seeks to investigate the structure of academics' personal networks on social networking sites, and to understand the role that these patterns of connection play for academics. Academic identity development is no longer constrained to the institution; rather, it is increasingly played out in the web-based online environment. The technologies used include tools (such as academic social networking sites) which have been specifically designed to facilitate this, although a wide range of generic tools may also be co-opted for academic purposes. The core research question in this study is concerned with the

networked nature of academic identity as constructed and mediated by social networking sites. What structure do such networks exhibit? How do academics view the construction of these networks and the role that they play in their online identity?

To this end, a mixed-methods social network analysis approach will be used. This will combine network analysis of academics' personal networks across up to four of the tools they use (Facebook, Twitter, LinkedIn, Academia.edu or Researchgate) with co-interpretive interviews to visualise the networks and discuss their significance from the academics' point of view. The study will make a theoretical contribution to Internet Studies by enhanced understanding of academic identity development online, and potentially a contribution to academic practice in the form of practical tips for academics in different subject areas or levels of seniority.

Project personnel and collaborators

Investigators

Give names and institutional attachments of all persons involved in the collection and handling of individual data and name one person as Principal Investigator (PI). Research students should name themselves as Principal Investigator and it is a requirement that a supervisor endorsement is sent to Research-Rec-Review@open.ac.uk to support the application. This should be sent before or at the same time as the application is submitted, preferably with the relevant HREC reference number or the application will not be processed.

Principal Investigator/ (or Research Student):	Katy Jordan
Other researcher(s):	
Primary Supervisor (if applicable):	Professor Martin Weller, Dr. Canan Blake

Research protocol

Literature review

Set within the context of a research agenda known as ‘digital scholarship’ (Weller, 2011), this project takes as a starting point a broader question of how networked online academic identity is constructed and mediated through the variety of media

channels online. This is a complex research area, being subject to pressures in relation to different technologies, career level or discipline. In previous studies, such factors have been examined in isolation, and studies have focused upon the contents of profiles while neglecting the network that they are embedded in. In contrast, this study will examine the structure and role of academics' personal networks from a sample of academics reflecting a range of stages of academic identity development and across the technologies they use.

In relation to technology

Online networked academic identity may be enacted through a range of online technologies, such as social media tools, blogs, collaborative tools, academic social networking sites (SNS) (Cann, Dimitriou & Hooley, 2011), but also institutional and personal web pages (Hyland, 2012). Tools vary in the roles that they can function, and the ways in which they are used by academics (Proctor, Williams & Stewart, 2010). Studies often focus upon one tool or platform, which may present only a partial view of online identity. Bukvova (2012) presents a contrasting 'holistic' approach in her analysis of scientists profiles across several online platforms (Xing, LinkedIn, ResearchGate, Academia.edu, FriendFeed, Identi.ca, Twitter, and personal web pages). The paper describes and validates a framework for analysis of online profiles, however focusing upon contents analysis of profiles does not consider the extent or ways that each is networked, or the creators' own opinions about their aims or uses of the platforms. While the study is valuable in its recognition of the multiple channels used by academics to form online identity and networks, whether the patterns vary according to subject or position and how this is viewed by participants are open questions. In addition to not wishing to limit the present study to one particular technology or platform, there is a secondary question of how online academic identity is mediated by particular tools, as the design and tone of social media sites can influence the types of interaction facilitated by the site (Papacharissi, 2009).

In relation to academic seniority

Several studies indicate differences in terms of seniority when constructing an online academic identity. Studies have focused upon a range of different tools, although each considers one platform in isolation so does not provide a holistic view of the variety of different tools and different uses.
Hyland (2011) presents a qualitative analysis of 100 academics' homepages; the sample was stratified to allow comparison between factors including discipline, academic seniority, and gender. Analysis focused upon four aspects of homepages: text choices; formatting and images; hyperlinks and connections. Academic seniority was identified as an important factor in the choice of text presented, "with assistant professors falling back on their qualifications and education in the absence of the publication and teaching records of their senior

colleagues." (Hyland, 2011, p.289) The inclusion of 'hyperlinks and connections' in this study contrasts with others reviewed here, which have emphasised content but not connections between profiles online. Hyperlinks and connections demonstrated differences according to all three factors: "Males, professors, and philosophers all created substantially more links and these were mainly to their departments, students and publications." (Hyland, 2011, p.295).

A group of papers have analysed online networked identity within the context of an academic SNS, Academia.edu, two focusing upon analysis of profile contents (Almousa, 2011; Menendez et al., 2012). Almousa (2011) collected and analysed data from 29,133 Academia.edu profiles across four disciplinary areas (Anthropology, Chemistry, Computer Science, Philosophy), and four levels of academic seniority (faculty members, post docs, graduate students, independent researchers). Across the disciplines, postdoctoral researchers and faculty members demonstrated the highest levels of profile completion and uploaded material. Postdoctoral researchers appeared to be the most active networkers, with the highest level of 'relationships' across all disciplines, and 'following' in all areas except Chemistry. The relatively low levels of participation by graduate students is perhaps quite surprising that graduate students do not seem to be more engaged; while activity frequency is comparable to postdocs and faculty across all disciplines, graduate students ask less questions than postdoctoral researchers, and post docs have highest levels relationships and 'following'. However, despite drawing upon a academic social networking site, the networked nature of profiles is ignored here.
Also focusing upon Academia.edu, Menendez et al. (2012) collected and analysed data from 30,428 profiles, quantifying aspects of profiles and examining differences based on categorical factors including academic seniority, country development category, and university ranking category. In contrast to Almousa (2011), the number of questions asked and number of questions users are following did not differ statistically according to academic position (Menendez et al., 2012). These two items were however the exception; all other items demonstrated statistically significant differences based on position, with more senior academics consistently being more proliferate in each respect than more junior scholars.

In relation to discipline

Becoming professional in a discipline or subject area is fundamental to development of an academic career. The readiness with which different subject areas may foster digital scholarly practices may be linked to the nature of the pre-existing research culture in different fields (Esposito, 2013).

In addition to the differences identified on the basis of position and gender, Hyland (2011) also based his sampling of academic web pages upon two

contrasting disciplines, Philosophy and Physics. In terms of text choices, disciplinary differences were identified as the most significant influence upon content, with a more formalised stance being used by Physicists in comparison to Philosophers. Differences were also identified in terms of hyperlinks and connections, with Physicists posting research-related links to a greater extent than Philosophers. Hyland (2012) built on this work, to compare identity construction in academics' institutional web pages, to their personal homepages. While personal homepages offer much greater freedom in terms of design than institutional ones, academic identity permeates the personal as well as institutional. The personal homepage is highlighted as playing an important role in constructing disciplinary identity, connecting with the broader community of the discipline rather than being tied to a particular institution (Hyland, 2012, p.320)

Almousa (2011) drew upon Academia.edu profiles across four disciplinary areas: Anthropology, Chemistry, Computer Science, and Philosophy. In contrast to Hyland (2011), no differences were found in terms of types of information and extent of profile completion according to discipline. Disciplinary differences were only found in relation to the posing and answering of questions, and this also depends on the level of academic seniority. In Anthropology and Philosophy, postdoctoral researchers pose and answer the most questions, while in Chemistry and Computer Science, independent researchers are the most active in this sense. Faculty and graduate students are only moderately active, and this is common to all disciplines.

Research focus and questions

While academic identity online has been the focus of a body of research, work remains to be done in order to gain a more comprehensive understanding of the networked and distributed way that this is enacted online. Existing studies found differences in engagement with digital scholarly practices in terms of both disciplinary differences and academic seniority. However, limitations include: drawing empirically upon just one type of online platform, analysis of content does not examine the fact that profiles are part of a network, i.e. connections between profiles, and analysis of content is not triangulated with the participants' viewpoints or intentions. In light of this, the study will focus upon the following Research Questions:

How is networked online academic identity constructed and mediated through the variety of media channels online?

Does the way that identity is presented differ according to the channel?

Are academics' online networks qualitatively different to their face-to-face networks?

Does networked online academic identity differ in nature according to discipline or different stages of academic career trajectory?

Methodology

A mixed methods approach to social network analysis will be adopted (Edwards, 2010), in order to explore patterns in personal network structure through social network analysis, in combination with qualitative research activities in order to address the networks' significance from the viewpoint of participants.

The project will require three phases for data collection:

1: Survey. This will be publicised online in order to gain as great a response as possible. It will collect a baseline of information about academics' use of social media to create their academic profile online, and ask participants to indicate whether they would be willing to participate as case studies in further detailed research activities (data collected will include participants' job position, discipline, social media tools used, level of use, basic information about purposes of using the tools, and willingness to participate further).

2: Social network analysis. For a sample of academics and with their consent, their personal networks (which will include their first-degree contacts) across up to four social media platforms will be sampled and visualised using social network analysis software. Reasons behind patterns observed will then be explored in phase 3.

3: Two semi-structured interviews will be held (individually) with the sample of academics who took part in the social network analysis activities. The first interview will explore their perceptions about the benefits of participation in such networks, motivations for creating profiles and connecting with others, and co-interpretation of patterns in the network graphs. The second interview will take place following analysis of the first interview and network graphs, in order to discuss the perceived validity of conclusions in relation to the themes of the Research Questions. Both interviews will take place via Skype, using screen sharing to facilitate a conversation around the network visualisations, and Camtasia software to record the screen and audio during interviews.

Participants

The first part of the study, the survey, will be open to any UK-based academics, and it is hoped that as many potential participants as possible will complete the survey**.**

Participants for subsequent detailed case studies (48 - see Recruitment procedures, below) will be UK-based academics sampled from those who complete the survey.

Recruitment procedures

Recruitment for participation in the survey will be carried out by publicising the survey via online social media channels (opportunistic sampling; Teddlie & Yu, 2007). Those who complete the survey will be asked to indicate whether they would be willing to take part in network analysis and interview activities. The participants for the case studies will be sampled from within this pool, based on criteria relevant to the study (purposive sampling; Arber, 2001; Maxwell, 1998; Teddlie & Yu, 2007). Aiming for a sample of 48 (stratified according to 2 factors - 12x each of four disciplinary areas, 12x each of four levels of academic seniority).

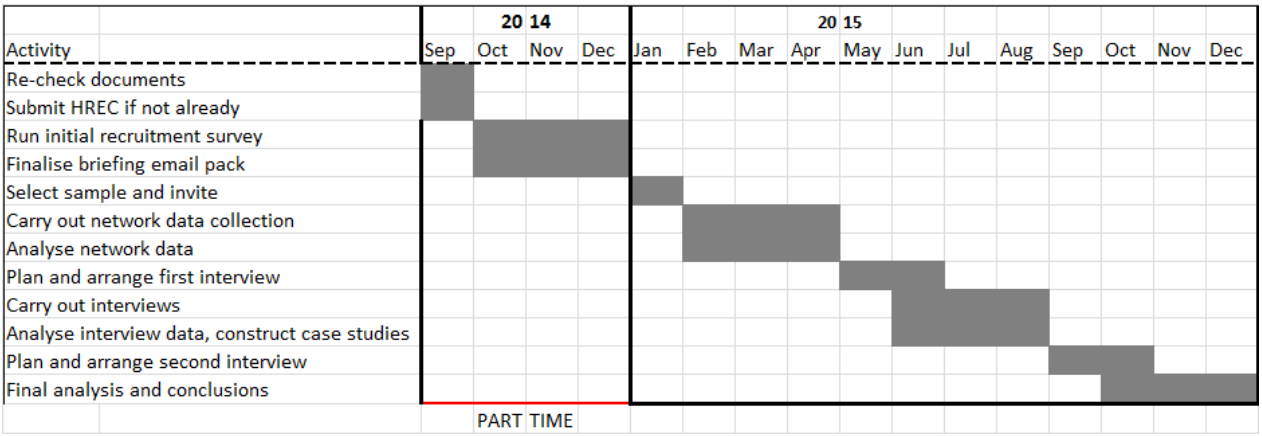
Consent

Informed consent will be sought from participants prior to data collection. The Recruitment survey will include an introductory text for participants to read prior to starting the survey, outlining the purpose of the data collection, how it will be stored, anonymity in reporting, and the right of the participant to withdraw from the study at any point prior to the anonymisation of the survey data.
When recruiting participants for detailed case study data collection, information about the project and the consent form will be given to potential participants in a briefing email. This will include a 'worked example' of network data collection and visualisation (using my own profiles) and explain the purpose of the interviews. No network data collection or interviews will be held before consent has been obtained, and this will be checked verbally at the beginning of each interview.

Location(s) of data collection

In all of the research activities, data collection will be carried out online.

Schedule



Key Ethics considerations

Published ethics and legal guidelines to be followed

The study will be guided by the Open University documents regarding the 'Code of practice for research at The Open University', and 'Ethics principles for research involving human participants'. It will additionally draw upon ethical guidelines published by associations which specialise in research relating to the methods which will be used in different phases of the project.

Social network data collection will be guided by the ethical guidelines of the Association of Internet Researchers (AoIR: available online at http://aoir.org/reports/ethics2.pdf). In doing so, the project will acknowledge that the online data collection is created by human participants, and respect data collected from this medium as if it had been collected directly from people, protecting identity and anonymising data. The AoIR guidelines also highlight the importance of considering context: in this case, data collection will be from public online profiles, which it is not unreasonable to expect have been published by the users with the intention of being seen, so this is not a sensitive area in this sense.

Survey and interview-based data collection will be influenced by guidelines from several notable organisations concerned with qualitative social and educational research, primarily:

- the Economic and Social Research Council (ESRC; http://www.esrc.ac.uk/_images/Framework-for-Research-Ethics_tcm8-4586.pdf)
- the British Educational Research Association (BERA; http://bera.dialsolutions.net/system/files/3/BERA-Ethical-Guidelines-2011.pdf)

Drawing upon these guidelines, the need for informed consent, anonymity for participants, and a commitment to minimise risks to participants are guiding principles in data collection.

Data Protection

I have completed the 'Data protection questionnaire for students', and included it with the HREC form submission. Allowing for the funded period of my PhD (which runs to July 2016) and one year after in case publishing research outputs extends beyond the PhD, it is anticipated that the earliest date for destruction of the data would be 2017. The latest date would likely be around two years later, if unforeseen circumstances disrupt my studies.

Recompense to participants

No recompense will be offered to participants, as interviews will be held online, so the level of inconvenience is low.

Deception

No deception is required in the course of the research project.

Risk of harm to participants

As (i) interviews will be held either online from a location of the participants' choice, (ii) the participants will all be adults, and (iii) the topic of the interviews is not likely to be sensitive or cause distress, the risks associated with conducting the interviews is low.
The main risk of harm to participants is likely to be distress caused in the event of loss or unintended publication of non-anonymised data. To safeguard against this, non-anonymised data will only be stored on secure Open University servers, or encrypted flash storage, accessible only to the researcher. No real names will be used at any point in discussing, writing up or reporting the research.

Debriefing

Interview participants will be given the option to opt in to receive a summary of the research findings at the end of the study.

Project Management

Research organisation and Funding

This research is funded by a CREET doctoral studentship.

Red Form Ref No.:

Other project-related risks

None.

Benefits and knowledge transfer

The research will be of benefit to participants and society in general in two ways:
- it will make a theoretical contribution to understanding of online interactions and identity development.
- its findings may be useful in terms of enhancing academic practice, by providing an insight and guidance into the potential and best practice relating to academic social networking online.

Declaration

I declare that the research will conform to the above protocol and that any significant changes or new ethics issues will be raised with the HREC before they are implemented.

I declare that I have read and will adhere to the following two OU documents:

- OU Code Of Practice For Research and Those Conducting Research
- OU Ethics Principles for Research involving Human Participants

In order to conform with OU governance guidelines, brief information on OU research approved by the HREC will be added to the **Research Ethics website**. The HREC will assume that you agree that the following data from your research can be made public via the website unless you tick the box below:

HREC reference number	Project title	Faculty	Approval date	Type of HREC approval

☐ No, I do not wish for details of my HREC approved research to be publicised.

Name:	Katy Jordan
Unit/Faculty:	Institute of Educational Technology
Telephone	58068
E-mail	Katy.jordan@open.ac.uk
Signature(s) (this can be the typed name(s) of investigator(s) if an electronic copy is submitted (which is preferred)	Katy Jordan
Date:	21-09-2014

End of project final report

Once your research has been completed you will need to complete and submit a final report to the HREC. A copy of the template can be found on the Research Ethics website at http://www.open.ac.uk/research/ethics/human.shtml#Final_report.

Proposed date for final report:	June 2016

Appendix E: Items included in the Nature survey and the online survey

Figures for each category are shown as a percentage of the total number of responses for each survey.

		n	Not at all useful	Not very useful	Quite useful	Very useful	I don't know
Raising your personal profile in the research community	Nature survey	3508	6.7	23.9	37.4	19.1	12.8
	Online survey	528	2.1	9.7	43.2	33.3	10.4
Raising the profile of your work in the research community	Nature survey	3508	6.6	20.0	41.1	21.0	11.3
	Online survey	528	2.5	10.6	42.4	34.3	9.3
Attracting funding	Nature survey	3508	33.9	29.6	11.0	5.5	19.9
	Online survey	528	27.8	26.5	7.6	2.8	32.8
Attracting future employers	Nature survey	3508	20.5	25.5	22.1	7.4	24.5
	Online survey	528	12.9	21.2	25.0	8.3	31.1
Sharing authored content	Nature survey	3508	9.1	16.6	39.1	23.3	11.9
	Online survey	528	5.3	7.0	37.7	40.3	8.3
Attracting collaborators	Nature survey	3508	12.4	27.1	31.1	12.4	17.0
	Online survey	528	5.9	16.9	37.5	20.6	17.8
Viewing other researchers' professional profiles on online networks is a useful way of determining what research I should be reading	Nature survey	3508	8.9	12.1	28.5	37.3	13.1
	Online survey	526	2.3	12.9	28.3	38.2	18.3
I feel I should probably do more to promote my research using online networks	Nature survey	3508	3.4	6.0	20.6	46.4	23.7
	Online survey	526	1.7	13.3	25.7	42.6	16.7
I don't think having a professional profile on an online network is very important for a researcher	Nature survey	3508	21.5	37.4	23.4	12.6	5.1
	Online survey	524	42.7	39.9	11.5	5.3	0.6

Appendix F: Characteristics of academics included in the network sample

ID	Job	Discipline	Subject	Academic SNS
3	Professor	Social Sciences	Other – Media practice	Academia.edu
4	Professor	Social Sciences	Other – Health services research	ResearchGate
51	Professor	Social Sciences	Other – Demography	ResearchGate
52	Professor	Social Sciences	Politics	Academia.edu
5	Lecturer	Social Sciences	Culture & Media studies	Academia.edu
6	Lecturer	Social Sciences	Economics	ResearchGate
8	Lecturer	Social Sciences	Sociology	Academia.edu
49	Lecturer	Social Sciences	Culture & Media studies	Academia.edu
50	Lecturer	Social Sciences	Economics	ResearchGate
9	Researcher	Social Sciences	Politics	Academia.edu
12	Researcher	Social Sciences	Sociology	Academia.edu
47	Researcher	Social Sciences	Other - Criminology/Sociology	Academia.edu
48	Researcher	Social Sciences	Politics	Academia.edu
54	Researcher	Social Sciences	Science & Technology Studies	Academia.edu
11	Researcher	Social Sciences	Psychology	ResearchGate
14	PhD student	Social Sciences	Politics	Academia.edu
16	PhD student	Social Sciences	Sociology	ResearchGate
44	PhD student	Social Sciences	Culture & Media studies	Academia.edu
45	PhD student	Social Sciences	Urban studies	Academia.edu
46	PhD student	Social Sciences	Sociology	Academia.edu
15	PhD student	Social Sciences	Psychology	ResearchGate
17	Professor	Natural Sciences	Biology	ResearchGate
18	Professor	Natural Sciences	GEES	ResearchGate
19	Professor	Natural Sciences	GEES	ResearchGate
20	Professor	Natural Sciences	GEES	Academia.edu
21	Lecturer	Natural Sciences	Biology	ResearchGate
22	Lecturer	Natural Sciences	Biology	ResearchGate
23	Lecturer	Natural Sciences	GEES	ResearchGate
24	Lecturer	Natural Sciences	GEES	Academia.edu
7	Lecturer	Natural Sciences	Psychology	ResearchGate
25	Researcher	Natural Sciences	Biology	ResearchGate
26	Researcher	Natural Sciences	GEES	ResearchGate
10	Researcher	Natural Sciences	Psychology	ResearchGate
27	PhD student	Natural Sciences	Biology	ResearchGate
28	PhD student	Natural Sciences	GEES	ResearchGate
29	PhD student	Natural Sciences	GEES	Academia.edu
30	PhD student	Natural Sciences	GEES	Academia.edu
31	Professor	Arts & Humanities	History	Academia.edu
1	Professor	Arts & Humanities	Archaeology & Classics	Academia.edu
2	Professor	Arts & Humanities	Archaeology & Classics	Academia.edu
32	Lecturer	Arts & Humanities	Dance, Drama & Music	Academia.edu
33	Lecturer	Arts & Humanities	English	Academia.edu
34	Lecturer	Arts & Humanities	History	Academia.edu
35	Lecturer	Arts & Humanities	Religion	Academia.edu
53	Lecturer	Arts & Humanities	Dance, Drama & Music	Academia.edu
36	Researcher	Arts & Humanities	English	Academia.edu
37	Researcher	Arts & Humanities	History	Academia.edu
38	Researcher	Arts & Humanities	Art & Design	Academia.edu
39	Researcher	Arts & Humanities	Philosophy	Academia.edu
55	Researcher	Arts & Humanities	Philosophy	Academia.edu
40	PhD student	Arts & Humanities	English	Academia.edu
41	PhD student	Arts & Humanities	History	Academia.edu
42	PhD student	Arts & Humanities	History	Academia.edu
43	PhD student	Arts & Humanities	Philosophy	Academia.edu
13	PhD student	Arts & Humanities	Archaeology & Classics	Academia.edu

Appendix G: SNA metrics for all participants

G.1. Twitter

SNA metrics for all participants based on their personal networks on Twitter. Participants whose networks were too large to be sampled are shown in italics.

ID	Nodes	Degree	InDegree	OutDegree	Communities	BCNormalised	Density	Reciprocity
1	1116	1498	1023	475	5	0.27	0.05	0.34
2	1007	1223	821	402	4	0.36	0.03	0.31
3	558	713	360	353	8	0.6	0.01	0.24
4	1315	1531	1123	408	4	0.62	0.05	0.19
5	449	594	286	308	6	0.49	0.04	0.36
6	138	167	86	81	3	0.24	0.16	0.4
7		*3350*	*2472*	*878*				
8		*4439*	*2170*	*2269*				
9	773	999	579	420	5	0.46	0.04	0.36
10	98	127	48	79	4	0.51	0.05	0.34
11	296	384	118	266	4	0.44	0.05	0.34
12	1933	2613	832	1781	5	0.58	0.02	0.34
13	1204	1632	957	675	5	0.37	0.06	0.39
14	1517	1929	1122	807	5	0.53	0.02	0.28
15	531	587	71	516	5	0.17	0.08	0.32
16	938	1310	558	752	5	0.38	0.05	0.4
17	635	936	443	493	4	0.4	0.06	0.44
18		*2970*	*844*	*2126*				
19		*4430*	*3311*	*1119*				
20	416	579	312	267	5	0.53	0.05	0.44
21	216	251	118	133	3	0.23	0.1	0.25
22	19	23	14	9	3	0.36	0.25	0.5
23	1756	2238	1510	728	6	0.36	0.03	0.29
24	1284	1666	973	693	5	0.42	0.03	0.35
25	467	614	197	417	5	0.5	0.05	0.31
26	1462	2081	777	1304	4	0.35	0.04	0.33
27		*7800*	*6925*	*875*				
28		*6919*	*6209*	*710*				
29	844	1097	439	658	5	0.46	0.04	0.26
30	332	472	197	275	3	0.41	0.08	0.41
31		*6440*	*4395*	*2045*				
32	1492	2051	849	1202	6	0.64	0.02	0.31
33	1049	1285	391	894	4	0.33	0.04	0.27
34	894	1057	846	211	5	0.14	0.09	0.4
35	1166	1387	1132	255	3	0.47	0.02	0.37
36	2480	3234	1826	1408	5	0.25	0.04	0.3
37	286	381	137	244	4	0.23	0.1	0.36
38	1310	2066	1209	857	5	0.59	0.02	0.46
39	196	259	98	161	7	0.68	0.04	0.34
40	833	1245	544	701	5	0.29	0.08	0.48
41	1132	1838	938	900	5	0.46	0.05	0.56
42	906	1293	400	893	4	0.28	0.06	0.45
43	908	1192	798	394	5	0.46	0.02	0.45
44	1684	2545	1239	1306	6	0.55	0.02	0.42
45	1403	2219	1170	1049	5	0.45	0.04	0.5
46	700	1004	424	580	4	0.43	0.04	0.4
47		*6093*	*5651*	*442*				
48	254	322	157	165	4	0.53	0.05	0.35
49	708	902	600	302	5	0.41	0.04	0.27

ID	Nodes	Degree	InDegree	OutDegree	Communities	BCNormalised	Density	Reciprocity
50	338	394	209	185	4	0.27	0.08	0.2
51	1450	2047	943	1104	5	0.39	0.04	0.27
52	1681	2208	660	1548	6	0.37	0.03	0.25
53	263	421	180	241	7	0.74	0.03	0.47
54	72	94	41	53	5	0.49	0.02	0.38
55	2476	3320	1319	2001	5	0.54	0.08	0.32

G.2. Academic social networking sites

SNA metrics for all participants based on their personal networks on academic SNS.

ID	Nodes	Degree	InDegree	OutDegree	Communities	Betweenness	Density	Reciprocity
1	566	749	551	198	4	0.39	0.04	0.48
2	171	170	170	0	4	0	0.08	0.48
3	127	165	107	58	3	0.47	0.06	0.28
4	124	139	86	53	5	0.37	0.06	0.22
5	160	221	109	112	4	0.57	0.05	0.42
6	64	94	46	48	5	0.61	0.08	0.48
7	76	112	74	38	3	0.6	0.08	0.43
8	169	243	84	159	4	0.5	0.07	0.3
9	92	126	68	58	5	0.51	0.04	0.39
10	144	200	81	119	5	0.59	0.04	0.34
11	18	13	9	4	2	0.09	0.18	0.31
12	74	83	17	66	5	0.49	0.05	0.3
13	126	184	72	112	5	0.53	0.08	0.5
14	89	113	52	61	4	0.54	0.04	0.34
15	14	13	13	0	2	0	0.27	0.07
16	223	250	30	220	5	0.34	0.04	0.2
17	14	13	13	0	2	0	0.14	0
18	263	277	260	17	5	0.18	0.05	0.47
19	87	118	77	41	5	0.55	0.06	0.35
20	91	105	86	19	5	0.46	0.04	0.3
21	54	69	31	38	4	0.49	0.07	0.39
22	58	73	52	21	3	0.55	0.11	0.41
23	81	119	60	59	4	0.59	0.09	0.38
24	245	285	183	102	5	0.43	0.03	0.29
25	18	23	7	16	2	0.46	0.23	0.58
26	96	134	69	65	4	0.57	0.06	0.41
27	76	90	29	61	4	0.43	0.06	0.41
28	184	230	61	169	5	0.42	0.08	0.37
29	47	68	31	37	5	0.57	0.05	0.5
30	37	53	34	19	2	0.46	0.12	0.29
31	138	171	131	40	5	0.41	0.03	0.42
32	286	388	179	209	7	0.63	0.02	0.45
33	57	91	53	38	4	0.62	0.1	0.59
34	213	309	161	148	6	0.47	0.05	0.47
35	97	121	89	32	5	0.5	0.06	0.4
36	254	359	207	152	5	0.56	0.04	0.47
37	85	109	45	64	3	0.4	0.11	0.48
38	119	174	68	106	6	0.61	0.06	0.48
39	42	65	30	35	4	0.43	0.18	0.47
40	40	56	21	35	4	0.59	0.09	0.42
41	173	268	134	134	5	0.62	0.04	0.54
42	34	39	21	18	4	0.32	0.13	0.37
43	57	83	45	38	4	0.6	0.07	0.46
44	226	352	198	154	5	0.55	0.04	0.5
45	28	10	6	4	5	0.01	0.09	0.6

ID	Nodes	Degree	InDegree	OutDegree	Communities	Betweenness	Density	Reciprocity
46	36	51	31	20	5	0.72	0.08	0.54
47	200	265	177	88	4	0.49	0.05	0.4
48	34	60	29	31	4	0.69	0.15	0.86
49	65	83	39	44	4	0.42	0.1	0.44
50	10	12	9	3	1	0.36	0.2	0.5
51	195	334	162	172	5	0.53	0.09	0.44
52	2173	2986	1891	1095	5	0.5	0.01	0.26
53	34	45	30	15	3	0.31	0.21	0.4
54	202	285	160	125	8	0.63	0.02	0.32
55	136	192	80	112	5	0.6	0.04	0.4

Appendix H: Gould and Fernandez brokerage scores

H.1. Academic social networking sites

Gould and Fernandez brokerage scores for the participants' personal networks on academic SNS. Modal type is shown in bold blue.

ID	Job	Discip.	Coordinators	Itinerant brokers	Representatives	Gatekeepers	Liaison
1	Prof	ArtHum	20414	11444	22428	**30292**	18068
2	Prof	ArtHum	0	0	0	0	0
31	Prof	ArtHum	523	340	**1823**	643	1588
32	Lect	ArtHum	4543	1755	**13956**	4670	11666
33	Lect	ArtHum	168	143	397	479	**573**
34	Lect	ArtHum	965	2180	3588	4138	**10825**
35	Lect	ArtHum	445	134	560	**831**	640
53	Lect	ArtHum	16	30	**128**	40	61
36	Res	ArtHum	2095	3412	7263	4965	**11919**
37	Res	ArtHum	377	280	**983**	421	398
38	Res	ArtHum	521	683	1213	1713	**2653**
39	Res	ArtHum	46	77	155	212	**310**
55	Res	ArtHum	1429	433	**2756**	1627	2205
13	PhD	ArtHum	613	805	2357	1059	**2464**
40	PhD	ArtHum	107	31	**225**	128	151
41	PhD	ArtHum	2644	1360	4001	**4530**	4299
42	PhD	ArtHum	21	14	105	41	**140**
43	PhD	ArtHum	229	72	**517**	297	438
17	Prof	NatSci	0	0	0	0	0
18	Prof	NatSci	444	341	658	1349	**1387**
19	Prof	NatSci	135	284	471	662	**1282**
20	Prof	NatSci	144	52	555	196	**593**
7	Lect	NatSci	336	297	**692**	591	564
21	Lect	NatSci	193	64	239	**341**	214
22	Lect	NatSci	97	116	**342**	171	273
23	Lect	NatSci	185	293	619	695	**1267**
24	Lect	NatSci	1993	1709	**7390**	1953	4692
10	Res	NatSci	1099	826	2279	2065	**2844**
25	Res	NatSci	18	3	**40**	18	11
26	Res	NatSci	534	300	912	1139	**1188**
27	PhD	NatSci	286	88	307	**568**	382
28	PhD	NatSci	1044	825	2382	2195	**2432**
29	PhD	NatSci	**404**	22	284	263	120
30	PhD	NatSci	261	0	17	**306**	0
3	Prof	SocSci	786	506	**1921**	1018	1365
4	Prof	SocSci	432	240	**1559**	542	1273
51	Prof	SocSci	2854	1868	6738	5498	**7371**
52	Prof	SocSci	302301	141955	**805394**	259569	524514
5	Lect	SocSci	909	1076	2360	2509	**4404**
6	Lect	SocSci	189	171	526	409	**680**
8	Lect	SocSci	2062	1102	**5510**	1609	1543
49	Lect	SocSci	196	142	**616**	213	334
50	Lect	SocSci	5	0	**12**	3	0
9	Res	SocSci	463	216	734	1079	**1238**
11	Res	SocSci	14	0	17	**30**	11
12	Res	SocSci	245	32	**537**	105	159
47	Res	SocSci	2354	1093	**5171**	2493	2842
48	Res	SocSci	143	28	**233**	207	159
54	Res	SocSci	5638	590	**5766**	4199	3264

ID	Job	Discip.	Coordinators	Itinerant brokers	Representatives	Gatekeepers	Liaison
14	PhD	SocSci	790	101	**1084**	545	530
15	PhD	SocSci	0	0	0	0	0
16	PhD	SocSci	735	333	1638	1315	**2093**
44	PhD	SocSci	2788	2839	**9711**	4021	9194
45	PhD	SocSci	**145**	15	91	144	44
46	PhD	SocSci	88	18	100	**209**	158

H.2. Twitter

Gould and Fernandez brokerage scores for the participants' personal networks on Twitter.
Modal type is shown in bold blue.
Blank rows denote participants whose Twitter networks were too large to enable data collection via the API.

ID	Job	Discip.	Coordinators	Itinerant brokers	Representatives	Gatekeepers	Liaison
1	Prof	ArtHum	81881	50351	83607	**154919**	71538
2	Prof	ArtHum	98438	12805	52238	**111691**	33834
31	*Prof*	*ArtHum*					
32	Lect	ArtHum	36585	108461	177345	139766	**527287**
33	Lect	ArtHum	35219	38407	47516	**111277**	94308
34	Lect	ArtHum	30328	9622	32498	**47560**	26834
35	Lect	ArtHum	68665	24313	**82502**	60885	38753
53	Lect	ArtHum	10217	1410	**13371**	8482	8639
36	Res	ArtHum	200938	213850	421731	617812	**919115**
37	Res	ArtHum	1452	4203	6549	4749	**11554**
38	Res	ArtHum	94620	144153	252732	185806	**321897**
39	Res	ArtHum	1423	790	4605	2332	**5985**
55	Res	ArtHum	255906	249651	407027	761050	**879276**
13	PhD	ArtHum	49096	62725	162911	98872	**208911**
40	PhD	ArtHum	20266	41726	70889	63604	**140229**
41	PhD	ArtHum	100922	76180	209146	170391	**221487**
42	PhD	ArtHum	7673	68900	42402	47090	**158836**
43	PhD	ArtHum	48218	25875	63919	**86793**	79400
17	Prof	NatSci	13570	27215	48844	34443	**72762**
18	*Prof*	*NatSci*					
19	*Prof*	*NatSci*					
20	Prof	NatSci	6338	6735	17871	15423	**30216**
7	*Lect*	*NatSci*					
21	Lect	NatSci	1541	2083	2544	**4384**	2535
22	Lect	NatSci	20	8	12	**50**	6
23	Lect	NatSci	101244	103382	234867	225258	**365483**
24	Lect	NatSci	71651	88902	165069	133831	**173808**
10	Res	NatSci	913	114	873	**1023**	620
25	Res	NatSci	9902	3950	21586	15928	**26069**
26	Res	NatSci	42197	171725	150215	178355	**406436**
27	*PhD*	*NatSci*					
28	*PhD*	*NatSci*					
29	PhD	NatSci	21875	24346	48848	66950	**109279**
30	PhD	NatSci	11578	4085	10341	**16297**	5207
3	Prof	SocSci	10744	8766	33103	20364	**51608**
4	Prof	SocSci	54224	63493	86121	**110618**	84979
51	Prof	SocSci	55513	130932	217448	166272	**409811**
52	Prof	SocSci	73582	87539	181705	217994	**413734**
9	Res	SocSci	22417	25772	49427	53153	**76340**
11	Res	SocSci	2926	2431	8310	5401	**10157**

ID	Job	Discip.	Coordinators	Itinerant brokers	Representatives	Gatekeepers	Liaison
12	Res	SocSci	80566	239094	246562	284165	**577606**
47	*Res*	*SocSci*					
48	Res	SocSci	6189	706	**9179**	4057	4175
54	Res	SocSci	276	133	**695**	346	473
5	Lect	SocSci	5273	7814	17050	15493	**37024**
6	Lect	SocSci	906	231	534	**3078**	690
8	*Lect*	*SocSci*					
49	Lect	SocSci	17592	14228	**67533**	19873	52477
50	Lect	SocSci	875	4997	9574	2649	**15251**
14	PhD	SocSci	24663	121909	180683	84324	**466282**
15	PhD	SocSci	3922	2524	9993	6470	**10599**
16	PhD	SocSci	18505	46056	73361	66204	**182370**
44	PhD	SocSci	183834	108929	372497	347757	**544245**
45	PhD	SocSci	50188	181219	279995	138795	**510416**
46	PhD	SocSci	23661	24004	59470	45109	**78223**

H.3. Bar charts

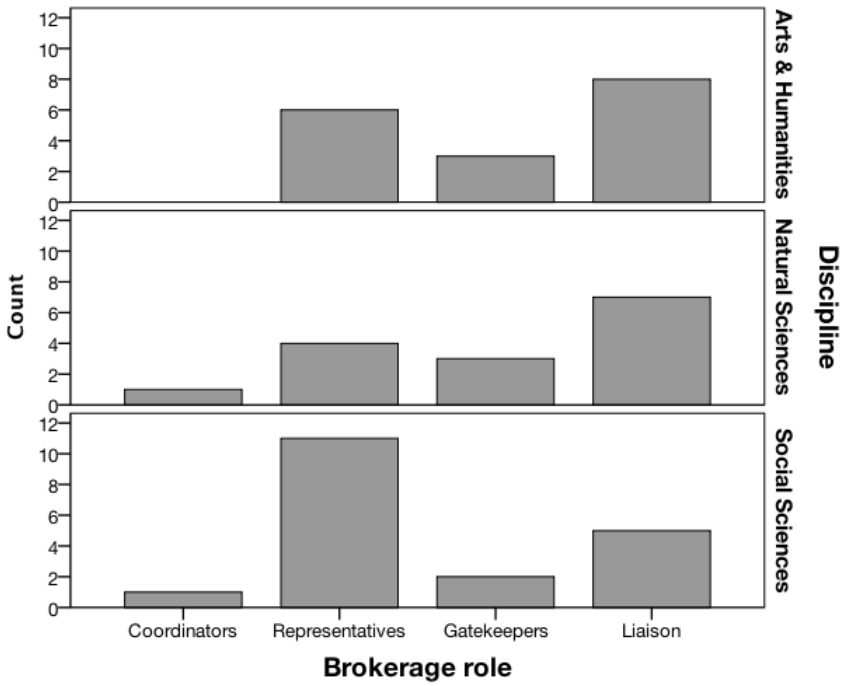


Figure H.3.1: Frequency of brokerage types observed in the academic SNS personal networks according to discipline.

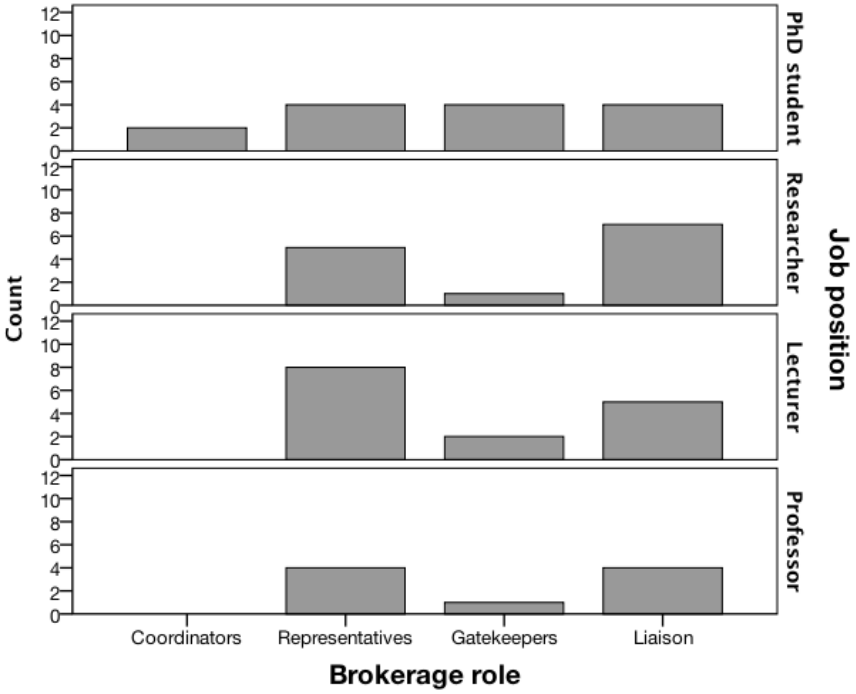


Figure H.3.2: Frequency of brokerage types observed in the academic SNS personal networks according to job position.

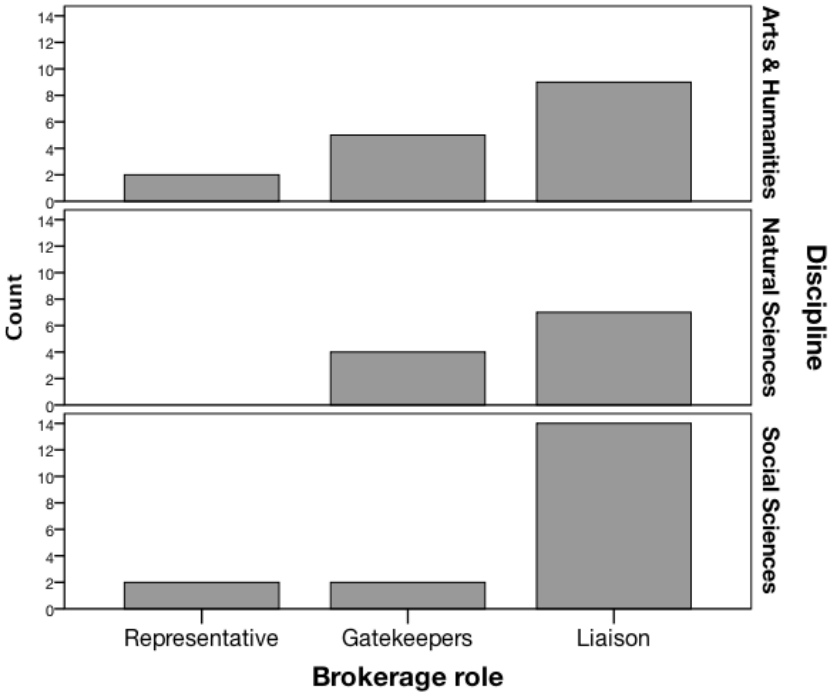


Figure H.3.3: Frequency of brokerage types observed in the Twitter personal networks according to discipline.

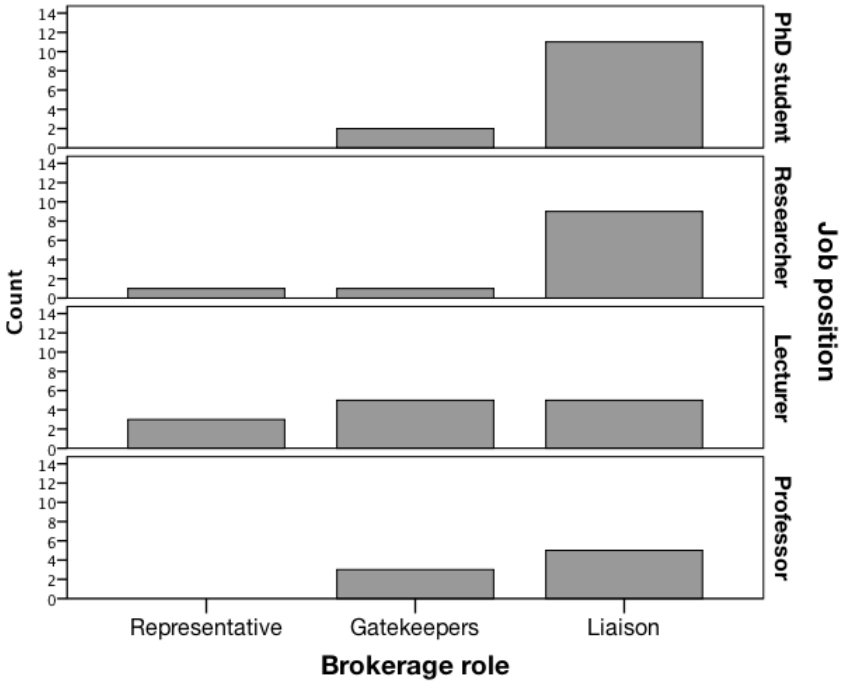


Figure H.3.4: Frequency of brokerage types observed in the Twitter personal networks according to job position.

Appendix I: Additional case studies

I.1. Beth

Beth is a researcher in Sociology. Previously, she worked in Education at 'University A', and undertook a PhD at 'University B'. She is based in the UK and currently works for an overseas university ('University C').

She uses a range of social media platforms: she is most active on Facebook, visiting daily, and visits Academia.edu and Twitter on a weekly basis. She also has profiles on Google+, Google Scholar, LinkedIn, ResearchGate and Zotero, but rarely uses them.

Academia.edu was selected as Beths' academic SNS for the study as she uses it more extensively; Beth has invested time in developing her Academia.edu profile and is yet to see a reason to move or develop ResearchGate as well. Despite this, a small community of followers has developed on ResearchGate though, mainly based on her institutional affiliation.

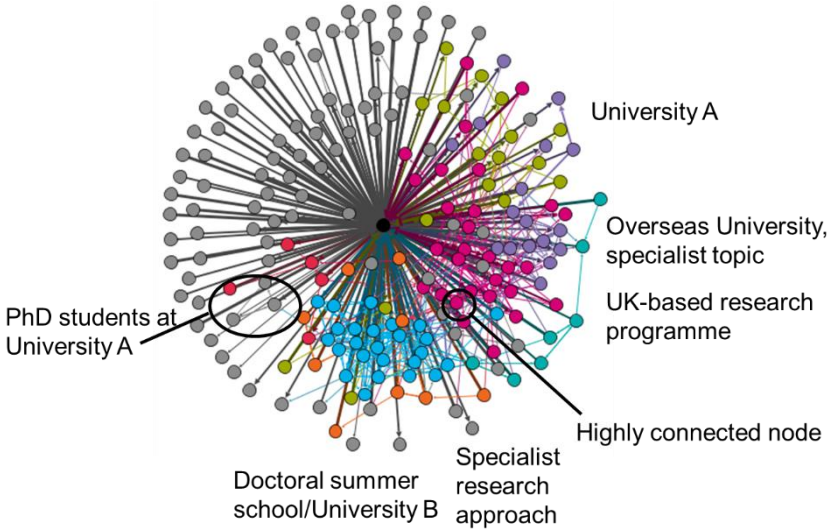


Figure I.1.1: Beth's Academia.edu ego-network.

Beths' Academia.edu network, Figure I.1.1, is relatively large. She is in the upper quartile for number of nodes, in-degree and out-degree and her network shows a high level of inter-connectivity. An unusually high number of communities are present – eight – and Beth's ego betweenness centrality is the third highest in the sample, while she is in the lower quartile in terms of clustering. This provides a

challenge for distinguishing communities, although she commented that she could distinguish some clustering together due to “either interest groups, or physical groups, or both”.

Having changed fields since her undergraduate degree, Beth identifies a number of unconnected nodes she follows as being contacts from her “previous life”. Her use of Academia.edu may reflect her identity as an interdisciplinary researcher to an extent, as she finds her professional niche. “I feel like there is this kind of etiquette that people follow and you kind of specialise in doing that and I’m not particularly coherent in anything, maybe it reflects more my other interests outside of work”.

Beth’s network strongly reflects connections with people who she has worked with in the past, and there are both geographic and “theoretical interest” elements to the communities. Beth identified one postdoctoral researcher as playing an interesting role, being connected to four of her communities; she attributes his position to having worked on projects in a number of different countries and frequently presents at European conferences.

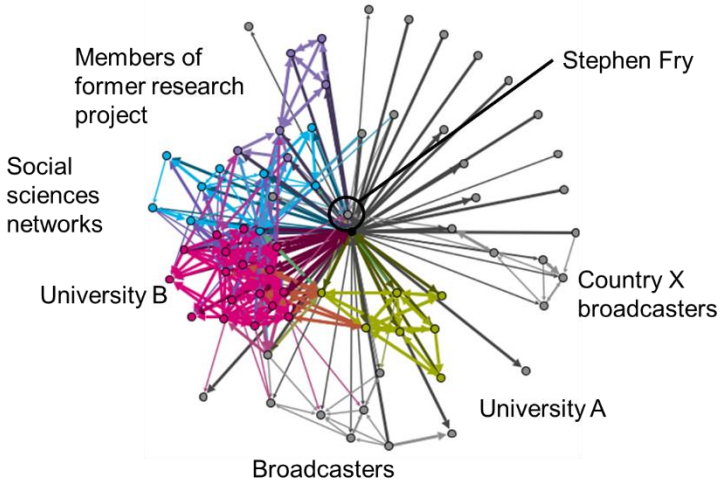


Figure I.1.2: Beth's Twitter ego-network.

In contrast, Beth’s Twitter network, Figure I.1.2, is smaller and more dense than the average networks in the sample. It is the second smallest in terms of nodes, in-degree and out-degree; upper quartile for density.

Beth doesn't consider herself an avid Twitter user; she signed up at the time because her employer, a knowledge exchange programme at University A, wanted her to tweet about events they organised. Following this, her account "lay dormant" for a couple of years and she became re-engaged with it when a history project of personal interest was tweeting events over a period of time to re-create key parts of a historical event which her ancestors were involved in. "That was the reason why I returned to Twitter; I'd always tried to keep away because I think it is such a Pandora's Box and I'll never leave if I go into it – it takes up too much of my time if I start."

Twitter has found its way back into Beth's professional life to an extent since then, mainly as a source of information. She does not share much herself via the platform, and feels like she has yet to identify her subject or audience via Twitter.

Nodes which Beth follows and do not sit within communities are friends from a range of "different places". Twitter connections related to work are more likely to be people who Beth has worked with before, rather than wanting to work with in the future: "it's easier to click on the people who you've worked with and who you know, I don't really seek people out. I might have done that when I was doing my PhD, I might have been looking out for people who were working with [specialist research approach] at the time, but not recently, I've got enough on my plate".

I.2. David

David is a lecturer in Geography, Earth and Environmental Sciences at 'University D'. He identifies himself as a Social Scientist rather than a Natural Scientist, due to his academic background. Whilst finishing his PhD (at 'University A'), David took a part-time research post in Education at 'University B'. After completing his PhD, he worked in Culture and Media Studies at 'University C', and now holds a permanent position in Geography at 'University D'.

David uses most of the social media platforms addressed by the survey, to different extents. He checks Facebook and Twitter on most days, he visits Academia.edu, a blog, and Google Scholar most weeks. He also has profiles at Google+, LinkedIn, Mendeley, ResearchGate and Zotero, but uses them infrequently.

David signed up to Academia.edu around the time that he was finishing his PhD (2010). At the time, he was also looking at collaborative citation systems (such as Mendeley and Zotero) as part of the research project he was working on at the time at University B, which was looking at "alternative metrics for reward and recognition", so his use of the platform initially began as an object for the research itself ("I signed up to everything").

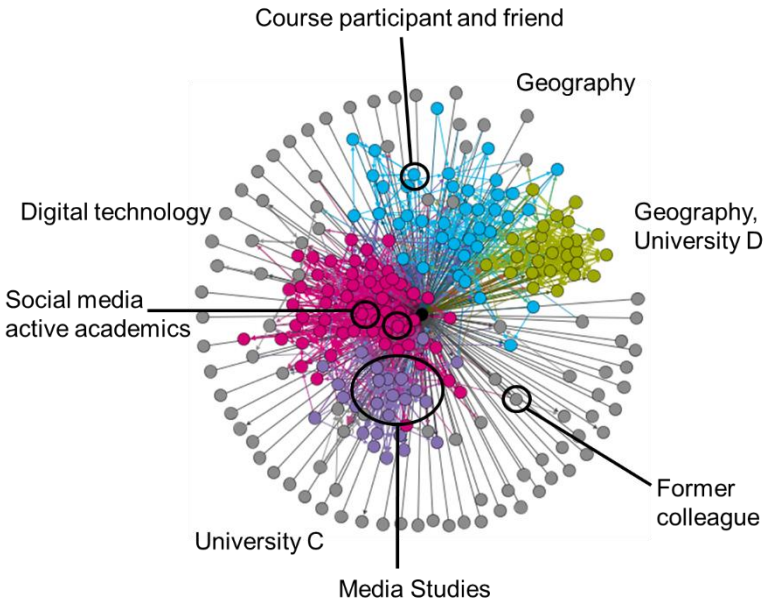


Figure I.2.1: David's ego-network on the Academia.edu platform.

David's Academia.edu network, Figure I.2.1, stands out in relation to several metrics. His network is relatively large. Being in the upper quartile in terms of nodes, in-degree, out-degree, and number of communities. On the other hand, it is particularly low in terms of density, reciprocity and clustering, being in the lower quartile. David's network brings together communities related to his diverse research interests – media studies, digital technology, and geography – and institutional communities.

Despite not having set out to use the site particularly, he has continued to use it although his engagement with the site has decreased recently, having been put off the site by their drive to link it to Facebook accounts (he has a Facebook account,

but only “begrudgingly” due to their politics and practices), and a lack of activity on the site.

David agrees that Academia.edu and ResearchGate are akin to maintaining a CV, and this is largely how he treats them. David signed up to ResearchGate around 2013, after seeing links to the site on Twitter. “People whose work I value, especially on ResearchGate, you tend to get early warnings of papers that are going to come out.” David gives an example of an academic who writes about a philosopher who he is particularly interested in, but “I have no kind of strategy for how I follow people, I’m not trying to solicit followers.”

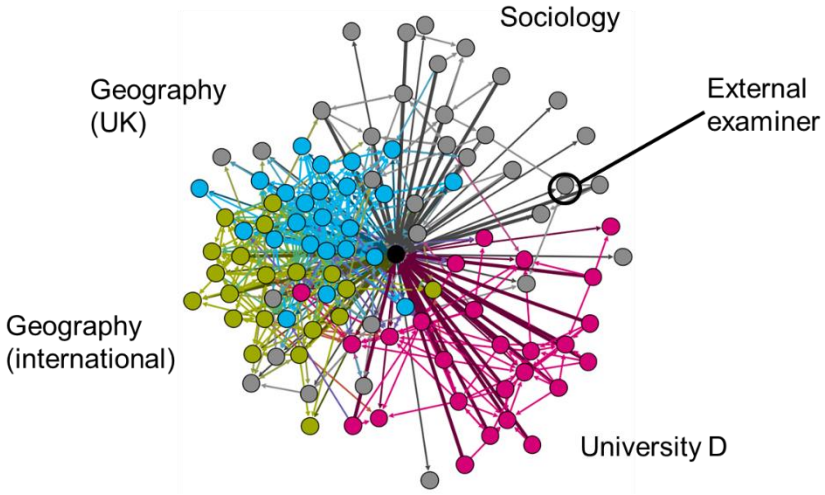


Figure I.2.2: David's ego-network on the ResearchGate platform.

The interview also considered David’s ResearchGate network, Figure I.2.2, as he feels that he uses this site more actively at present. His ResearchGate network is smaller than his Academia.edu network, which he attributes to having joined the site more recently, so has not had the time to accumulate as many followers. David started using the site at around the time that he got his current job; he decided to join the site as a result of seeing others posting links on Twitter to their papers hosted on the site. In contrast, the network is dominated by Geography as a subject area (reflecting broader disciplinary differences in population of the two sites), and his current institutional affiliation.

David got a Twitter account after being persuaded by the principal investigator on the project he worked with at University B in 2009. Like Academia.edu, David started using Twitter as a subject of the research project he was working on;

despite initially being a Twitter skeptic, he has since become an active user. “Twitter has been the most productive form of social media for my career by a long way, and there are people who I know in my discipline only through Twitter. I think a combination of Twitter and a JISCmail email list are the two discipline specific – I sort of think of Twitter as being slightly discipline specific in terms of my activity, ‘cos it’s the place where I most obviously perform my academic identity.”

David’s Twitter network, Figure I.2.3, does not fall within the extremes of the distribution of the metrics. The communities reflect the subject areas which underpin his interdisciplinary research focus, and the city of University C where he resides.

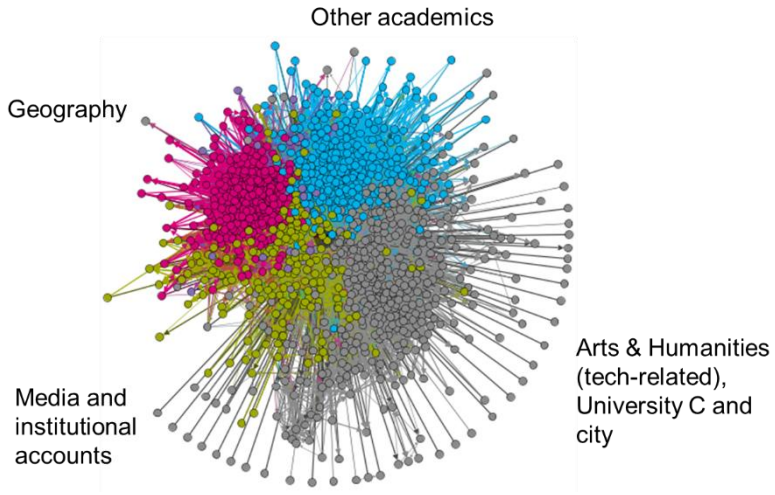


Figure I.2.3: David's' Twitter ego-network.

While David was aware that there were strong links to Geography and University A, the network structure did surprise him to an extent. “It doesn’t feel quite so segmented. ’Cos a lot of the time you know when you get replies to tweets that you put up, they’ll come from several people from each of those groups. In the sense in which a conversation is performed, it doesn’t feel quite so modular. […] Retweets come from all over the shop, @ replies more often than not come from people that I regularly converse with on Twitter or in person.”

David’s personal Twitter account is not the only one he is responsible for, and uses Tweetdeck to manage several accounts and streams. He also runs his departments’ Twitter feed; his research group also has a Twitter account, and he

helps run the Twitter account for a specialist research group he is part of associated with the Royal Geographical Society.

The departmental account is particularly important to him, ensuring that he retweets and publicises information about his department and colleagues in social and mainstream media, although it is time consuming. As a lecturer, David's current lectures are large-scale classes, so interaction via Twitter is not practical, although he may use it for smaller, more specialist options in the future. He has used Padlet with large classes, as a way of eliciting feedback.

I.3. Emily

Emily is a PhD student in Geography, Earth and Environmental Sciences at 'University C'. She is approaching the end of her degree and is currently applying for jobs; she does not intend to stay in academia, but would prefer to move into a policy-related role. She studied Geography at undergraduate and Masters level at an overseas university ('University A', in 'Country X'), moving to the UK to pursue a Masters at 'University B', before joining her current institution for her doctoral studies.

Emily most frequently uses Facebook and Twitter, which she visits on most days. On a weekly basis, she uses LinkedIn and a blog; although Emily doesn't have a personal blog, she has written posts for institutional blogs. She visits Academia.edu and Google Scholar monthly, and also mentioned Pessle, which she describes as "longer than twitter, shorter than a blog".

Emily started using Academia.edu in 2011, when she started her PhD. She doesn't consider herself to be very active on the platform, but does upload papers, conceptualising the site as "my portable repository of my papers".

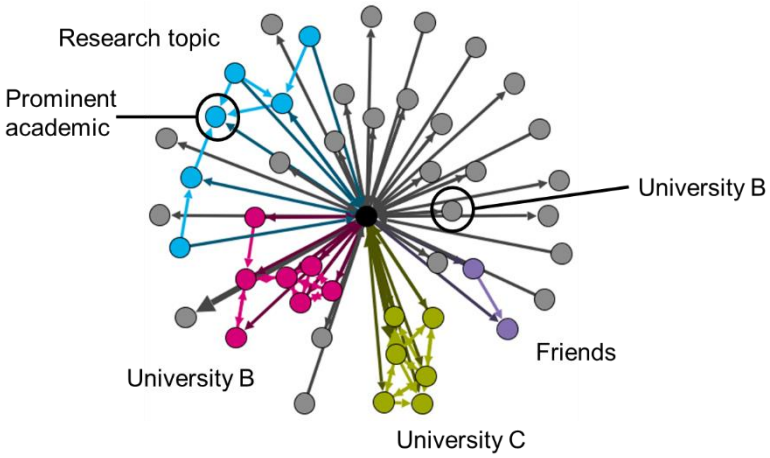


Figure I.3.1: Emily's ego-network on the Academia.edu platform.

Emily's Academia.edu network, Figure I.3.1, is relatively small, being in the lower quartile in terms of nodes. It is low in terms of clustering, and high in terms of reciprocity. Communities are mainly defined by institutions, although a large proportion of her connections are not part of communities. Emily's Academia.edu network, with the exception of unknown followers, are mainly people she already knows, and whose publications she is interested in keeping up-to-date with.

Although Emily hasn't comprehensively sought out connections on Academia.edu, she was surprised at how sparse the network was. "It's not like I've gone through my EndNote and gone oh these are my key authors […] but I use other mechanisms to get the same information I would get through that", such as Google Scholar alerts, which she views as more reliable and comprehensive than Academia.edu.

Emily actively uses social media in her research and online platforms to manage her profile, but this is not commonplace within her department. "I know it's more American, Academia.edu, but I find it funny that people wouldn't have a profile there at all. […] I have a profile on everything. I would rather manage my internet presence than have someone else manage it for me. I want to know what I'm putting out there, I want to know that the first thing that people click on is something that I've managed". Emily also signed up to ResearchGate, but doesn't use it. "I kind of feel like I've set my stall with Academia.edu, and I'm not going any

further. It's like Twitter and Instagram – I've got Twitter, I'm not going on to Instagram, I can't deal with too many."

Emily joined Twitter in 2011, as part of her doctoral research, primarily as a research site to discover links to individuals and blogs related to her research topic. She initially set up two Twitter accounts, one personal and one professional, but her use of the personal account has waned: "My personal account, it's locked and it's got a different handle and actually to be honest I very rarely use it and I've contemplated deleting it a few times because I don't use it." As part of her doctoral research, Twitter played a critical role in finding and engaging with research participants, through mutual following, direct messaging opened up a communication channel that would otherwise have been closed "'cos lots of the [potential research participants] don't have publicly-available email addresses and I wanted to talk to them". The ongoing relationship on Twitter with the research participants' community has allowed a level of trust to build up: for example, they tag Emily in to discussion threads.

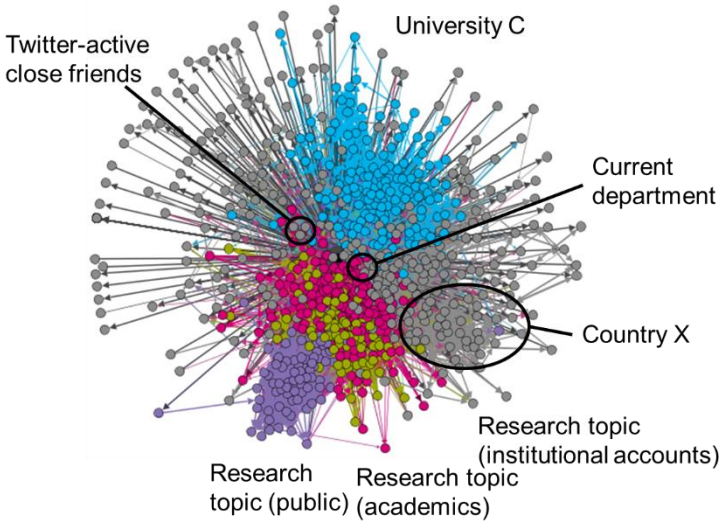


Figure I.3.2: Emily's Twitter ego-network.

Emily's Twitter network, Figure I.3.2, is in the lower quartile in relation to reciprocity, which may reflect her use of the network as an observer. The network comprises distinct communities reflecting different positions in relation to her research topic; there are also clear links to her current institution, and Country X.

In addition to using Twitter as a research site, Emily also uses it to promote her own academic publications, and as a source of information. “I definitely use it to communicate my work, so I use it to link to final papers, I use it to link to link I wrote a piece for The Conversation with one of my co-authors […] so definitely use it like a broadcasting mechanism. But then I also it to find out things. I have found actually really important papers for my work via Twitter”. Twitter has been of particular use recently, as Emily approaches the end of her PhD, to find out about job vacancies and gain insight into potential employers.

As a PhD student, Emily feels that she has been free to develop her own online identity. She perceives that working in academia affords greater freedom to do so than for example if working for a government organisation; and within academia, students have more freedom than staff members. However, she notes that this is accompanied by a sense of personal responsibility for how she portrays herself and her work online. Emily views her professional identity in different terms on different sites, Twitter being less formal than academic SNS, which she considers to be formal and akin to a CV. Although she does not intend to stay in academia after finishing her PhD, she plan to continue to use SNS professionally, as she has built up her “personal brand” in a sense, although she anticipates that the content of her tweets may need to be mediated depending on who she is working for.

I.4. Frances

Frances is a researcher in Economics at ‘University A’. She joined her current department over ten years ago, and has been promoted from junior to senior research roles during this time. Prior to this, she completed her PhD in Economics at the same institution. She is not a heavy user of social media. Her preferred platform is Twitter, which she checks every week. She is a member of academic SNS ResearchGate, which she visits on a monthly basis. She uses Google Scholar but visits the site infrequently, and created a Google+ profile but has not used it since. Frances does use Facebook, but not for work, only for friends (although colleagues may become friends): “being an academic you end up with friends all over the world”. While the majority of respondents selected ‘agree’ or ‘strongly agree’ for the following items, Frances selected either ‘disagree’ or ‘strongly ‘disagree’:

- *'Developing my online identity is important to me as an academic'*
- *'Social networking sites allow me to draw upon a wider community of expertise when I need help'*
- *'Being able to ask questions of the online community is important'*
- *'I see my profile as an online business card'*
- *'Social networking sites are a useful way to support working in collaboration with other researchers'*
- *'I present my identity in different ways on different sites'*
- *'Social networking sites are useful to discover job opportunities'*

In contrast, while the majority of respondents 'disagree' or 'strongly disagree' with the item *'I don't think having a professional profile on an online network is very important'*, Frances selected 'agree'.

Frances has used ResearchGate for the past two or three years. She was prompted to join the platform by receiving an invitation email from the site, based on co-authors who had already signed up, despite not being a user of other forms of social media: "I don't know why I agreed to this, because I'm not on LinkedIn, and I'm always ignoring those emails from LinkedIn. […] I think it seemed more academic." Frances has used the site quite actively since, particularly to keep track of the impact of her work. She adds information (but not full texts) about her publications as soon as they come out, and periodically responds to requests for full texts from other users. In Frances' department, social media is not viewed as a standard part of academic practice.

Frances's ResearchGate network, Figure I.4.1, was in the upper quartile in terms of ego betweenness centrality, clustering and reciprocity.

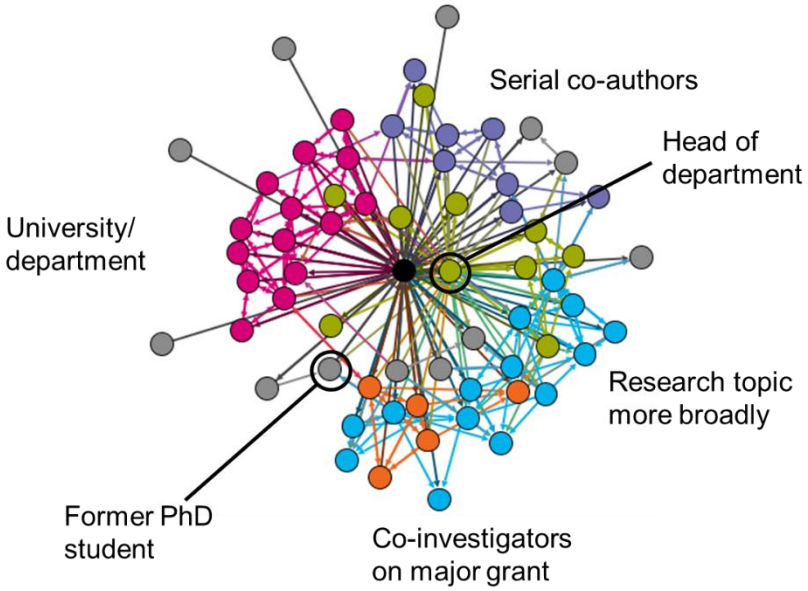


Figure I.4.1: Frances's ego-network on the ResearchGate platform.

On both ResearchGate and Twitter, Frances typically connects with academics who she knows personally, or already knows of through other colleagues, which may explain the high reciprocity. "I might not know them, in that I've never met them, but I know someone else that works in their department or we have a co-author in common or something, we know each other, and we'd be happy to stand and chat if we met at a conference, but that just hasn't happened yet." Additionally, "on ResearchGate I follow people who I've never met, but whose research I admire. […] I don't follow people with the expectation that they will follow me back, it would be more that they're likely to publish something that I'm interested in, and I'd rather know about it as soon as it came out". While several sub-groups were identified based on authorship and projects, the communities in her network mainly relate to her specialist research interests ("I don't see why you would follow someone if you're not interested in their research"), although a community also emerged according to her institutional affiliation. This distinction between institutional and topic-based communities may explain the high clustering and ego betweenness centrality of her network.

Frances has been using Twitter for a year. She uses Twitter for personal purposes as well as professional ("work, other academic interests, and just things that I'm interested in"), and is in the habit of checking it on a daily basis at the end of the working day. She started using Twitter on the recommendation of a colleague, the former PhD student highlighted in her ResearchGate network. He was visiting the UK and persuaded Frances that "Oh you have to be on Twitter, so I can tweet about coming to see you", so "under peer pressure with him standing beside me at my desk, I signed up".

Frances finds Twitter to be an easier way to keep up to date with information relevant to her research field without having to visit many websites (getting information in "a passive way"). Being able to easily configure the network is very important – Frances notes that you can simply unfollow someone if the information becomes irrelevant, and Twitter offers advantages over traditional media in that items which do not make it in to the news can still be found (from think tanks for example) via Twitter.

She primarily uses it for receiving information from others, rather than disseminating her own research; new publications are usually promoted via the departmental Twitter account. She recognises that there is an expectation for some personal interactions via Twitter: "you should try to be a little more light-hearted when you can be, 'cos I think people like to have this kind of mix, that there's an element of a personal connection".

Frances's Twitter network, Figure I.4.2, is relatively small, being in the lower quartile in terms of nodes, in-degree, out-degree, and number of communities. Her network is also in the lower quartile for ego betweenness centrality, and the upper quartile in terms of network density.

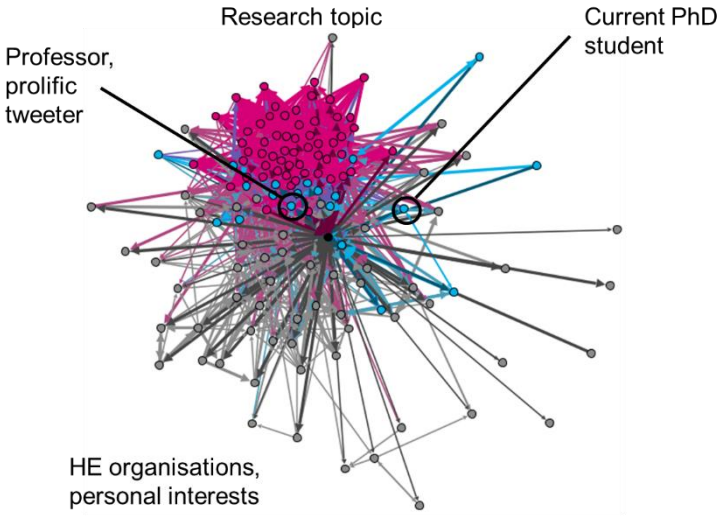


Figure I.4.2: Frances's Twitter ego-network.

This may reflect Frances's status as being highly embedded in her specialist research topic, which is a tight-knit group who "all really know each other", and reflects strong existing professional relationships offline fostered via frequent national and international conferences. "Especially in the UK, everyone knows everyone else, and we mostly work in research institutes, so I think that's also where the tight-knit community comes from." The community mixes some social tweeting with professional – Frances uses the example of a group tweeting about their dinner one evening at a conference: "It's very friendly and open".

Frances does not use Twitter to communicate with 'non-academic' friends and has a rule of thumb for navigating this divide: "If you wouldn't say it in small talk at a conference, don't post it on Twitter".

I.5. Harriet

Harriet is a professor in Geography, Earth and Environmental Sciences at 'University A'. She has been at her current institution for over a decade, joining as a lecturer, being promoted and was recently appointed head of her department. Her research specialism involves working closely with colleagues in Sociology, and other disciplines. Twitter is Harriet's preferred social media platform, which she uses on most days. She visits Google Scholar on most weeks, although she noted that she doesn't use it for the social networking features. On a monthly basis, she uses Academia.edu and a blog.

Harriet started using Academia.edu about five years ago, on the recommendation of a colleague. Initially, she did not use it to follow people, but rather as a repository for her papers, as her institution restricts access and editing rights to institutional pages. Use of the site as a personal repository rather than for interactions and making connections is reflected in Harriet's network, Figure I.5.1, in which followers outweigh following by approximately 5 to 1.

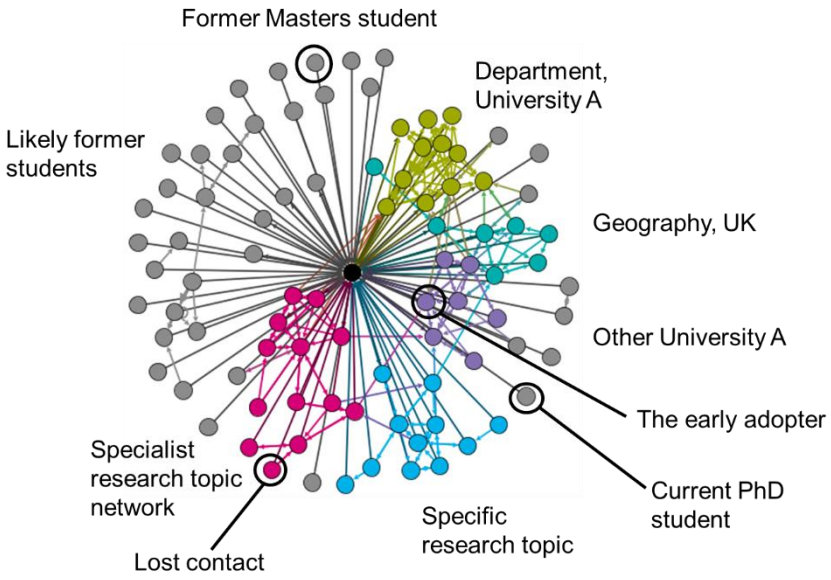


Figure I.5.1: Harriet's ego-network on the Academia.edu platform.

Her network is in the lower quartile in terms of out-degree, density, reciprocity and clustering: "Part of that is that I'm on ResearchGate as well, although I came to that much later, and my page is much less populated, because I've already done it

for Academia[.edu], I don't need to duplicate." Harriet does perceive a disciplinary divide in use of the two sites: "ResearchGate seems to have a lot of Geographers on it […] whereas on Academia[.edu], my networks around the more cultural side of what I do are better developed and the colleagues that aren't in my department [purple], they're all in the Arts and Humanities."

Although Harriet has also set up a ResearchGate profile, she finds the site "more naggy". "One of the things I like about Academia[.edu] is that it allows me to use it the way that I want, but it does mean that I'm quite passive, I just put stuff up there, although I do really value it when I get an email that says that somebody has posted a new paper, I do actually really value that, so I probably ought to think about that and follow a few more people."

The communities in Harriet's network mainly relate to her research topic, at different levels of specialisation, within Geography. Her institution is present, but at the departmental level rather than more broadly. The peripheral, less well connected nodes Harriet feels are likely to be former students.

Harriet started using Twitter over five years ago. She initially joined as a way of keeping in touch with her niece and sister. She sensed that Twitter would increase in popularity, "so I wanted to get in and get a username that I wanted. I joined with no particular intention of doing anything, I didn't know what I was going to do with it."

The structure of Harriet's Twitter network, Figure I.5.2, strongly reflects how she views her network. "I really love this; this was totally fascinating to me. It totally reflects my experience of Twitter."

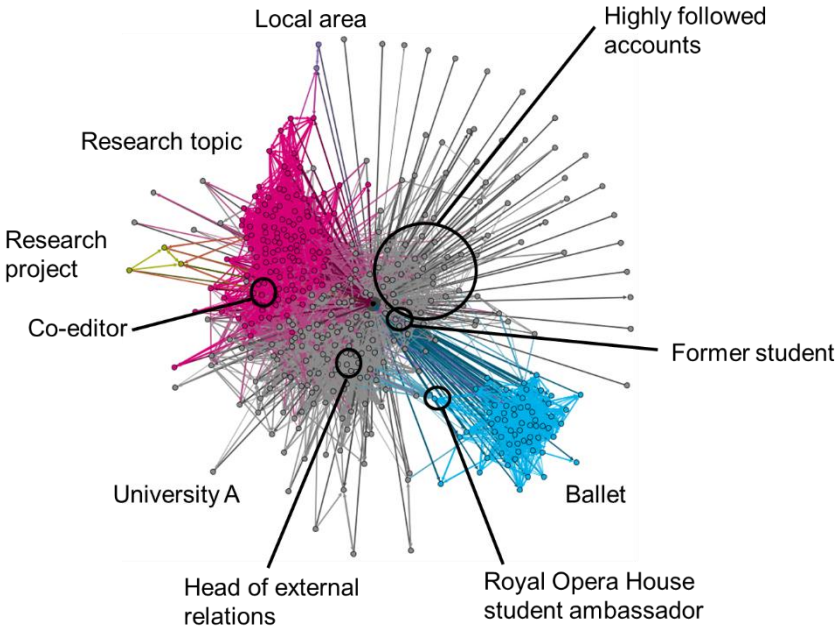


Figure I.5.2: Harriet's personal Twitter network.

Her network is relatively small, being in the lower quartile in terms of in-degree and out-degree. "One of the great things about this [seeing the visualisation] was that it made me feel less alone [laughs] […] I deliberately don't follow too many people, so my Twitter is sparse compared to some, but this made me feel like it was quite real, I'd got quite a lot of the right ones." It shows high reciprocity and ego betweenness centrality. This may reflect Harriet's combined use of Twitter as both a personal and professional channel. The communities in her network also merge personal and professional interests; the main communities present relate to her research topic, her institution, and her interest in ballet.

Since starting using Twitter for mainly personal reasons, she has found it to be a valuable way of enhancing existing relationships with colleagues: "it was kind of like you know the people who go outside and smoke and talk about everybody else, it was a little bit like that, that you were 'in', and I still know those people better […] and feel differently about them because we were Twitter friends".

In addition to building social interactions with existing colleagues, for Harriet Twitter also engages in interactions with potential future professional connections. "It's about feeling a sense of connection to people, and some of the really jokey things are great for that, they're really really good for that, like this person I was

interacting with yesterday morning who I'm sure I have met but I don't know, and so she wrote this haiku and I favourited it, and she like just got back to me and said could you do one about [research topic] and I thought oh wow, she knows my research, and so then I did but as part of it I got into a conversation with her about Shetland ponies, so when we meet, which probably will happen, we'll be really friendly to each other."

Harriet is aware of the need to tread carefully between personal and professional tones and audiences, although she hasn't experienced problems herself, and notes that it isn't just an issue for social media. This has happened via other online channels – Harriet describes an email list in her field, which a member posts inappropriate replies to ("they're really ill-informed, and he looks really bad"), and is perceived negatively by the community for doing so. "I know that he has really impeded his career from those interactions". Harriet doesn't feel impeded in her interactions in this respect, but knows how important they are, from her perspective as a senior academic involved in Recruitment. "I'm quite secure in my job, I'm quite senior, I'm not looking for a lot of help from people but I spend a lot of time reading CVs and shortlisting people and appointing people and I know how hard it is and how those things play out and people having warm fuzzy feelings about you is good, it matters."

Harriet indicated 'disagree' to the Likert scale item about "my online academic and personal identities are separate". "I have thought about it, and I've talked to people about it, and I have a couple of colleagues who have more than one Twitter ID in order to do that, but I decided that I'd tweet in a personal capacity you know, and I have a right to say whatever I want, like, within the law, to the same extent as anybody else does […] it is public, I guess is what I think, and it never crossed my mind to have a private Twitter account".

I.6. Pippa

Pippa is a lecturer in History at 'University A', where she has been a permanent faculty member at University A for nearly 10 years. Prior to this, she "moved around a lot"; as an undergraduate she studied at 'University B', before moving to 'University C' for her Masters and PhD. She held postdoctoral appointments for

one year at ‘University D’, and held two fellowships in different departments of ‘University E’. After returning to University B for a three year research fellowship, she joined University A.

Pippa visits Facebook and Twitter on most days. She uses Academia.edu and LinkedIn on a monthly basis; she has profiles on Google+ and Google Scholar but visits less than once a month.

Pippa started using Academia.edu in 2011, although she “accidentally deleted it about a year ago, so this load of connections are of a years’ existence, but most of the people I was previously in touch with.” Despite this, her Academia.edu network, Figure I.6.1, is relatively large, being in the upper quartile in terms of nodes, in-degree, out-degree and number of communities.

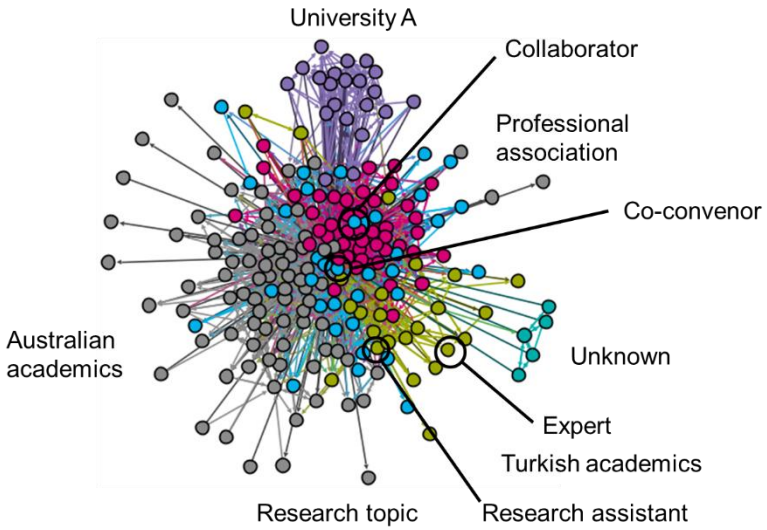


Figure I.6.1: Pippa’s ego-network on the Academia.edu platform.

She started using the site with a view to using it as evidence for a promotion application, to be able to show who and where people were reading her work. Since then, she has found other benefits from being part of the site, such as “finding out about other peoples’ research, just getting notifications of things they’re working on, and just a sense of who’s out there”. At the time, she was also in the process of writing a book, and set about building a network in order to publicise it when finished.

It is interesting that although Pippa has been affiliated with several institutions, they have not emerged as communities; rather, she has become embedded in her research interests. “I think that may be a function of, because I had to move and move and move again, perhaps the [topic] connections were the steady point in life. I mean I made friends at each of the places I went to, but mostly they weren’t people who I shared intellectual interests with.” A University A community is present (purple), but set apart from the main network.

As Pippa is an experienced academic in her field, she co-convenes the international society on her research topic, and this forms the core of her network. Apart from the University A community and a small, unknown community (teal), all other members of the network share the same research topic, and communities have emerged based on their geographic location (her research topic is linked to certain locations). Pippa estimates that she already knows around half of the members in her network, from previous working relationships, and the remainder she has met primarily online, through the professional society, or via publications.

Pippa started using Twitter at a similar time to Academia.edu, with the same intention of building up a network to promote her forthcoming book. Similarly, by using the site, she has found further benefits. Twitter has been perceived to be particularly valuable in maintaining a connection with what is “going on” professionally in order to overcome physical boundaries, such as being on maternity leave, or the distance between University A and London.

The geographically-dispersed interest in her research topic, reflected in her Academia.edu network, is not reflected in separate communities in her Twitter network, Figure I.6.2, but does add extra value to the network for Pippa: “I find it fantastically useful, especially as so many contacts are overseas and things.” Examples include live tweeting from public events being held to commemorate an event related to her research topic around the world, using the related tweets as a data source for research in itself, and crowdsourcing figures for her book.

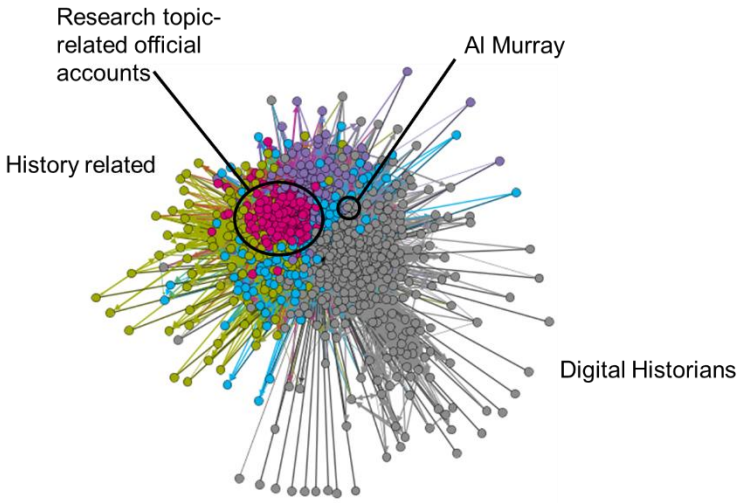


Figure I.6.2: Pippa's Twitter ego-network.

Pippa's Twitter network is in the lower quartile in terms of out-degree, which is explained by her remark that "I don't know if the stats bear it out, but on Academia.edu if someone follows me I tend to follow them back, but I don't do that on Twitter so I don't get cluttered up with rubbish." Her network is in the upper quartile in terms of density, and shows the lowest ego betweenness centrality in the whole sample.

Similar to her Academia.edu network, this suggests that Pippa has become highly integrated into the network related to her subject area, to such a great extent that it is difficult to distinguish what sets apart communities. "It's like a Venn diagram of academics who are interested in public history, people who are employed as public historians […], and then there's all these sort of local community groups that have sprung up that are interested in doing their local history research around the centenary, and they all interlink."

Pippa is mindful of keeping personal and professional issues separate online, and uses different surnames on different sites to draw explicit boundaries. While she views her Twitter account as mainly professional, she will tweet indirectly (via retweeting) about issues she feels strongly about such as politics and gender inequality. Although she hasn't encountered problems with her institution from this, she is aware that it could have an impact. "I do try and promote my institution a bit, particularly when we've got open days and things, and when there are events on

and things I do that kind of thing, but I try to do it sparingly because its obviously tedious for lots of people. So I try to be a good citizen of my university and I certainly, I take care not to get myself into trouble, I'm conscious of it being a public place where I've got my professional name and institution on."

Appendix J: Ego-network communities' categories

Participant	Academic SNS					Twitter			
	Co-authors	Institution	Institution+topic	Topic	Personal interests	Institution	Institution+topic	Topic	Personal interests
A	1	1				2			
B		3	1	2		2		2	2
C			3	2		1		3	1
D			1	3		1		1	1
E		3		1		1		3	1
F	2	1	1	1				2	1
G			2					4	1
H		1	1	3		1		1	1
I				2	1		1		4
J		2	1			1		3	1
K		2	2	1				3	1
L			3	4				4	1
M		1						5	
N		1		5		1		4	
O		2		2				3	
P		1		3				3	
Q		3	1	1		1		2	3
R		3		1		2			3
TOTAL	**3**	**24**	**16**	**31**		**13**		**43**	**21**